THE NATURE AND DYNAMICS OF CHANGE:

A Systems Approach to Exploring Organisational Change

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"Not in his goals, but in his transitions man is great."

(Ralph Waldo Emerson, 1803 - 1882)

"...understanding organisational change requires discovering the connections between the apparently prosaic and the apparently poetic in organisational life"

(James G. March, 1981: 575)

"Swift to its close ebbs out life's little day,
Earth's joys grow dim, its glories pass away;
Change and decay in all around I see
O Thou who changest not, abide with me"

(H.F. Lyte, 1793 - 1847)

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ABBREVIATIONS

BPR:	Business Process Re-engineering
BT:	British Telecommunications
CARE:	Communications and Attitude Research for Employees
DST:	Dynamical Systems Theory
EDC:	Embedded Dynamic of Change
EQA:	European Quality Award
ERCMU:	Employee Relations Change Management Unit
FB:	First Brand
FBI:	First Brand International
GPC:	General Principle of Change
GST:	General System Theory
IEM:	Information Engineering Methodology
O&M:	Organisation and Methods
QPB:	Quality Plan and Budget
TQM:	Total Quality Management
TSI:	Total System Intervention
VSM:	Viable System Model

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I dedicate this thesis to my parents, John and Edna Stickland.

DECLARATION

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ABSTRACT

There has been a significant increase in interest in the area of organisational change over the past thirty years. A multitude of approaches and methodologies have been proposed, developed and applied by organisational and management theorists, as well as systems and social scientists. Business practitioners and consultants have also not been hesitant in devising their own approaches to organisational change - undoubtedly attracted by the lucrative commercial gains they are capable of generating. It is the author's belief that much of this work focuses upon issues of change management: how to initiate, control and implement effective change within organisations. Yet the proliferation of such approaches in recent years belies an acute lack of any clear understanding of the very nature and essence of change itself.

This thesis seeks to explore the concept of change, as it is manifested and described across the sciences. Firstly, it surveys the organisational change literature, highlighting the dearth of research devoted to analysing change from a conceptual and theoretical perspective. A cross discipline approach based upon General Systems Theory is proposed, as a means of further investigating the phenomenon and concept of change. The basic premise being that a deeper understanding of *what* change is, will better inform and guide our attempts to manage it. In applying the approach, a number of views, definitions, paradigms and phenomena of change are examined from across the natural, physical and social sciences. The recurring themes, principles and unifying ideas from this review are used to construct an initial change framework.

This framework is not meant to be prescriptive, but rather is proposed as a qualitative analytical and descriptive tool with which to study change within organisations. To this end, two organisational case studies are documented, during which the framework is applied in an attempt to assess its analytical utility. The thesis concludes with some suggestions for further research, including ways in which the framework can be developed conceptually, and further applied practically within an organisational context.

CHAPTER 1

INTRODUCTION

"The world is changing faster than ever before. We are living in times of far reaching and profound transformations in the perceptions and structures of the world's politics, economics, demography, technology, ecology and ethics. These changes are evolving at a striking pace, and societies must now evaluate them and make the necessary adjustments."

(Kirdar, 1992: 8)

1.1 INTRODUCTION

This opening chapter provides a overview of the entire thesis. It begins with a brief discussion of why change as a concept and phenomenon is important, and why it requires further investigation, particularly within an organisational context. This is followed by a statement of the main objectives of this study and what it was intended to achieve. Then a brief summary is given of the research, chapter by chapter. Finally some issues relating to the scope and limitations of the study are discussed.

1.2 FOCUS OF STUDY

This thesis is concerned with the study and exploration of change. The ubiquity of change has long been acknowledged, as one commentator has noted (Engles, 1959: 82) "...nothing remains what, where and as it was, but everything moves, changes, comes into being and passes away...". According to Whitehead (1925: 179) change is inherent "...in the very nature of things." As a concept, it has increasingly become a focus of much interest and investigation. Across a wide range of disciplines attention is turning to issues of change: how can change be more effectively initiated, managed, implemented and accommodated? A general survey across the social sciences (including business, organisation and management fields) has revealed that the literature concerned with change has been expanding rapidly in many directions: between 1984 and 1995 the number of journals containing the word "change" in their title has more than doubled. Of the 1400 journals currently monitored by the Bath Information Data Services (BIDS - Social Science Database), over 550 are devoted to change of one sort or another.

Moreover, as numerous commentators have observed (see Badertscher, 1982; Callan, 1993), the rate of change seems to be accelerating in many spheres of human activity, and is now reaching unprecedented levels within our technological and industrial systems. It is difficult to say whether this is due to an actual increase in the occurrence of change as a phenomenon or whether we are merely becoming more aware of change activity and the problems associated with it. As Keohane and Nye (1989) have observed, the political, economic, technological and social affairs of mankind have become highly interdependent over the past two centuries, where a given change cannot be easily isolated and confined, but its effects can be felt faster and further afield than before. Coupled with the increasing interconnectedness of the world in which we now live, this makes change phenomena arguably more significant now than they were in the past. Whatever the case, the impact on our conceptual understanding of the world is not insignificant, as Goodman and Kurke (1982: 2) have stated "...the concept of change pervades all our intellectual endeavours."

Organisation theory and management science in particular has focused closely on developing effective strategies for managing innovation and change (see Burnes, 1992; Conner & Lake, 1988). Systems science has also been the source of many methodologies for achieving change across a range of problem situations and system contexts of an organisational nature - see for example Beer (1985); Checkland (1972); Flood and Jackson (1991a); and Jenkins (1969). Managers are now confronted with a bewildering array of methodologies, techniques and strategies to assist them in changing some aspect of their operation for the better.

However, the main thrust of much of this work has been to answer the practical 'how' questions - how change can be effectively dealt with. Arguably, the more fundamental 'what' questions have yet to be seriously asked at a generic level: What is the *nature* of change? What characteristics and attributes does change possess? What structural features, interactions and processes define change? What basic principles govern change, if any? What marks the beginning and end of change? What perception and measurement issues are associated with change? It is the firm belief of the author that these and other such probing questions need to be asked in an attempt to reveal the nature of change at a fundamental level. Despite the plethora of approaches and tools for managing organisational change, there has yet to emerge any solid theoretical framework for exploring and describing its nature and dynamics. Practical approaches to change management continue to multiply in number, often as 'one off' solutions to specific problems. But as one commentator has observed:

> "Practice is static. It does well what it knows. It has however no principle for dealing with what it doesn't know.... Practice is not well adapted for rapid adjustment to a changing environment. Theory is light footed. It can adjust itself to changing circumstances, think out fresh combinations and possibly, peer into the future." (Litwick 1987: 15)

Organisational change practice - for better or worse - is well established but far from fleet of foot. It is the author's belief that greater theoretical and conceptual insight would make it far more responsive to the capricious demands being placed upon it.

1.3 OBJECTIVES OF STUDY

The research described in this thesis has six main objectives. Firstly, to highlight the under-emphasis within the organisational change literature of research into the nature of change - exploring *what* change is as opposed to describing *how* it can best be managed. This is not to denigrate practical change methods, tools and approaches that have been developed to date. Rather, it is hoped that a deeper conceptual understanding of change will lead to the development of new practical approaches, which better represent and embody the fundamentals of the phenomenon they are designed to deal with.

A second objective is to determine whether a General System Theory (GST) investigative approach can deliver some conceptual output of benefit to organisational change theorists and practitioners. One of the ideals GST advocates is the pooling of similar concepts from a range of subject domains in an attempt to derive a generic picture for a given phenomenon. This thesis proposes and follows an approach that embodies this ideal.

A third aim of the research is to explore the *notion* of change as a concept, examining its philosophical underpinnings and cognitive representation. Associated with this is a fourth objective to explore the *phenomenon* of change as an observable manifestation across a range of disciplines - using the GST approach mentioned above. The pursuit of these two related objectives should lead to an increased awareness of the many and varied descriptions, explanations and conceptual representations of change that exist.

Fifthly, to construct a conceptual scheme or framework which describes some of the generic aspects and features of change phenomena. It is anticipated that this will be of use as an analytical and descriptive tool for organisational change theorists and practitioners. Clearly a comprehensive and thorough application of the framework proposed here to a range of organisational scenarios, is beyond the scope of this thesis. Nonetheless, an attempt to make an initial assessment of the utility and analytical potential of the framework is undertaken with two case studies.

Finally, as a longer term objective, it is hoped that the GST research approach adopted here and the results it generated will stimulate further debate in the organisational change literature; specifically: about the *nature and dynamics* of change, and the investigative methods employed to examine change phenomena.

1.4 STRUCTURE AND SUMMARY OF THESIS

Chapter 2 attempts to define and highlight the problem upon which this research is focused: specifically, an under-conceptualisation of the notion and phenomenon of change within organisational and management thinking. It begins with an examination of how the concept of change has been captured and portrayed in the organisation theory literature. Organisational change theory can be split broadly into theories based upon individual behaviour, group/team dynamics and organisation/system change. These categories are examined briefly. The three main strands of organisational thinking up to the early 1970's are discussed, namely the Scientific-Rational, Human Relations and Contingency theory paradigms. The multitude of approaches and schools of thought on organisational change that have emerged since the early 1970's are also listed, and classified by: the dominant root metaphor that underpins them; the extent to which they contribute to practical change management techniques and methods on the one hand, and theoretical and conceptual understanding of change on the other; the focus of analysis each organisational change approach takes, whether it be technology, human, process, function or system change. Following this, a number of attempts that have been made to explore organisational change from a conceptual perspective are discussed.

The purpose of this brief review of the literature is to provide an overview of the many diverse approaches to organisational change. It also highlights the tendency of research to focus upon prescriptive ways in which change can be managed.

In Chapter 3, GST is introduced. The investigative approach based upon it, which is employed during the course of the research, is explained in detail. This can be summarised as follows. An attempt is made to explore how change is perceived, represented and described across a range of disciplines. This involves and examination of the *notion* of change, as well as the identification and analysis of specific change phenomena. Any recurring themes, isomorphisms, common attributes and emerging principles from this analysis are then collated and used to construct a conceptual framework which describes change generally, for later application to a given subject domain - in this case organisational thinking.

Several theorists who have adopted a cross-discipline approach to organisational analysis are also discussed in Chapter 3. Their work demonstrates the creative potential and benefit of looking beyond the confines of one's own discipline.

Chapter 4 begins to apply the GST approach outlined in Chapter 3, by exploring the *concept* of change across a range of disciplines. Some of the philosophical issues and debates that underpin differing perspectives on change are discussed. Various definitions, hypotheses, issues and views on what change is and how it can be represented are examined, from both the social and physical sciences.

Chapter 5 then examines a number of change phenomena from the natural and physical sciences. They are classified broadly under physics, chemistry and biology although many are the domain of splinter sub-disciplines. The purpose here is to explore actual descriptions used to document the change phenomena, drawing upon the language and imagery of the source domain to highlight conceptually insightful metaphors which describe change generically. Where possible, common themes and recurrent ideas are identified.

All the analytical work of the previous chapters is brought to focus in Chapter 6. Here, a conceptual framework is proposed which attempts to describe the nature and dynamics of change at a generic level. It has its roots in the notions and phenomena descriptions explored in the preceding chapters. Clearly, it is limited to the extent that only a finite number of change perspectives and phenomena have been examined to create it. Nonetheless, it represents a genuine initial attempt to uncover some of the fundamental aspects of change.

Chapters 7 and 8 then take this initial framework and apply it direct to two organisational scenarios. The first is within British Telecom plc, and the second concerns a small UK based drinks distribution business called First Brand International. The purpose here is to make some assessment of the descriptive and analytical utility of the framework when applied to organisational change phenomena. The changes investigated during these case studies cover strategy, structure and behaviour.

Finally, Chapter 9 summarises the main findings and conclusions of the research, and examines to what extent the objectives outlined in section 1.3 have been met. Some of the ontological and epistemological issues that were encountered during the course of the study are discussed - particularly with reference to the transfer and application of concepts from one subject domain to another. Some suggestions for further research are made, relating to the GST approach adopted, the initial framework it produced, and the manner and scope of the framework's application. The thesis concludes by outlining what original contributions this study has made - to both the systems science and organisational change literatures.

1.5 SCOPE AND LIMITATIONS OF THE STUDY

This thesis does not seek to advance a comprehensive grand theory of change which is all encompassing. The author is all too well aware of the dangers of advancing some "...heroic simplification out of which theoretical mischief can come" (March 1981: 571). Rather, its purpose is to begin to explore change as a concept and phenomenon, and hopefully to stimulate more debate in the literature. By necessity what is written here can only be an initial foray into the subject. Nonetheless it is hoped that in time, the investigative approach and inchoate framework proposed will lead to a deeper and more complete understanding of the dynamics of change within organisations.

In a similar vein, the change concepts and phenomena examined in this study are not proposed as definitive or exhaustive. Indeed, there are numerous examples of change phenomena within the natural and physical sciences that could have been included. The purpose is merely to determine whether the GST approach proposed here is capable of delivering some conceptually insightful notions to construct an initial framework. For this, only a limited sample could be reviewed. As Chapter 6 demonstrates, there is scope within the framework for additional perspectives and knowledge about change to be included, should others wish to build upon those documented here. It is the sincere hope of the author that others will indeed develop the framework further.

With regard to the vast organisational change literature that already exists, it is not the purpose of this thesis to explore and review every school of thought, paradigm or methodological approach. Chapter 2 outlines what are perceived to be the principal areas of work, and several classifications for them are suggested. To review them all in detail would be sufficient work for another thesis on its own. Moreover, with respect to the specific objectives of this research, such a review is not considered appropriate.

Finally, a note regarding the practical application of the framework outlined in Chapters 7 and 8. The two case studies described by no means constitute sufficient testing of the framework within an organisational setting. Given its generic nature, parts of the framework were not even relevant within the two organisational change contexts considered. Clearly, in time, further application within a variety of settings will be required to assess the legitimacy and soundness of the framework and the concepts embedded within it. Chapter 9 suggests some ways in which this may be achieved as one recommendation for further research. The two case studies seek to demonstrate how the change framework can be applied as an analytical and descriptive tool, and whether it provides any benefit and utility as such. Furthermore, the findings and output of the research are not intended to be used in a prescriptive manner within organisations, but rather a means of guiding inquiry when dealing with organisational change phenomena. Planned, deterministic methodologies for change abound already, and it is in response to these, and the author's first hand experience of their limitations and failings, that this research was undertaken.

Appendix A contains a glossary of terms whose meaning may need clarification within the context of this thesis. While it is normal practice to define terms at the earliest opportunity, defining what is meant by the term *change* at this point presents a difficulty. As one of the objectives of this thesis is to explore the concept and phenomenon of change in detail, the author faces the dilemma of providing a working definition of the term 'change' at the risk of pre-judging it and forcing meaning upon the concept before it has been fully investigated. Nonetheless, the following broad statement of definition is given for the term: "...making or becoming different; difference from previous state..." (Oxford Dictionary, 1984: 115) - with respect to a given entity or system. That is to say, the substitution, replacement or exchange of the *entire* system under study, with another, is not considered within this research. However, the substitution etc. of component parts or elements *within* a system does fall within the scope of this thesis.

This is the only definitional distinction and constraint made at this stage. In a review of the organisation theory literature, Chapter 2 highlights issues and problems of definition further, while Chapter 4 returns to the definition given above and also explores a range of other interpretations and meanings for change.

CHAPTER 2

THE PROBLEM DEFINED:

What is this Thing Called Change?

> *"The singular goal of science is to understand humankind and its environment. From a scientific point of view, the study of organisational change processes is attractive because organisational change is not well understood. There is much to be learned relative to what is known. Only a small fraction of existing organisational theory is change related. There are fertile fields to be ploughed."*
>
> (Huber and Glick, 1993: 12)

2.1 INTRODUCTION

This chapter seeks to explore how change has been perceived within organisational thinking over the past one hundred years. It begins with an examination of how organisational theorists have conceived of change, spanning the period 1900 to the early 1970's. This focuses broadly upon three strands of thinking: the scientific-rational view; the human relations view; and the contingency view. Then the organisational change literature from the 1970's to early 1990's is mapped and classified in a variety of ways including: by root metaphor; by theory - practice orientation; and by focus. The main branches of organisational change theory are also discussed: specifically, theories of change based upon individual behaviour; group dynamics; and organisational system change. Following this review, the problem which the thesis addresses itself to is considered: namely, that little attention has been given to defining *what* the nature of change is as a phenomenon within organisations. The principal attempts to explore the nature of change that have been documented in the literature are discussed, and various classifications of the material are suggested. The chapter concludes with a summary of the main points made.

2.2 CHANGE: EARLY ORGANISATIONAL THINKING REVIEWED

Evidence of thinking about organisations can be traced back many hundreds of years. It is not the intention here to give a detailed history of organisational and management thought as this has been done elsewhere (see Claude, 1968; Wren, 1979). Views on the importance of good administration and organisation can be found expressed as far back as the ancient Chinese and the writings of Confucius (Hsu, 1932); the early Egyptians (Lepawsky, 1949); and the Greeks (Crombie, 1963; Burnyeat, 1990). The Roman Empire was founded on clear principles of administration and military organisation. Indeed one of the most long lived formal organisations is the Roman Catholic Church (Mooney, 1947).

However, the widespread appearance of observable, large scale commercial organisations as entities did not take place until the Industrial Revolution (Ashton, 1948; Pollard 1965). It was at this time that the formal organisation of work became an issue of concern as factories sought to utilise their labour efficiently. During this period, what has become known as the classical or Scientific-Rational school of organisational management emerged.

2.2.1 The Scientific-Rational View of Change

From the late nineteenth century up until the 1930's, thinking on organisational structure, design and management was dominated by this approach. It was advocated by several theorists, including Davis (1928); Gulick and Urwick (1937); Fayol (1916); Mooney and Reiley (1931); Gilbreth and Gilbreth (1914) and arguably the most influential writer of this period, Taylor (1903; 1911). The underlying canons of the approach were:

- o The organisation of human work activity is a science.
- o Human work activity is motivated by financial reward.
- o Organisations are rational, machine like structures capable of efficient, output maximizing behaviour.
- o Clear definition of responsibilities and duties in the division of labour and rigid management hierarchies are essential to effective working.

Understanding of the concept of change during this period was limited. Change was seen as a planned and managed phenomenon. It was directed at increasing control over individual endeavours, ensuring they were subordinate to corporate interests. Change was functionally orientated, concerned with altering specific job actions to achieve maximum efficiency. The premise that there was a best way to perform a given task which would work equally well in all situations, drove change activities through a very limited area of the total possibility space. The belief that an optimum solution was achievable and maintainable at maximum efficiency at the *task level* resulted in change being enforced by experts on the individual. There was no conception of external sources and dynamics of change occurring in an organisation's environment, or indeed any internal mechanisms for adaptation. Change was centred around what was perceived to be the objective measurement of variables which could be assessed and calculated in a scientific manner. Taylor's writings (1903; 1911) suggest there was no concept of change at more abstract, intangible and conceptual levels of an organisation like culture or public image. Individual creativity and innovation as a source of change seem to have been untapped. Figure 2.1 below summarises early practice, experiences and conceptions of change within organisations.

Change Focus:	job / task
Measurement:	micro variables, hard, objective, quantifiable
Driver for change:	'maximising' behaviour; belief in existence of a best way
Transformation: (direction)	sub-optimal TO perceived optimal individuality TO cooperation discord TO unity heterogeneity TO standardisation uncertainty TO institutionalisation variety & diversity TO complexity reduction
Methodology for change:	scientific, functionalist, planned, reductionist, institutionalising

Figure 2.1 The Scientific-Rational Perception of Change

Essentially then, the notion of change was seen as associated with: internal, operational issues only; hard measurement and quantification; rational, maximising behaviour; subjugating individual interests to achieve standardisation and unity of purpose; scientific, reductionist analysis and methods. Hence, change was largely an internal planned affair, driven by a unitary world view and focused on the rational, mechanical nature of work at the operational level only.

2.2.2 The Human Relations View of Change

From the 1930's onwards theorists began to focus more on the human individual within organisations as a reaction against the machine like regimes advocated by the Scientific-Rational writers. What emerged became known as the Human Relations approach and was founded upon the work of authors such as Mayo (1933); Myers (1934); Barnard (1938); and more indirectly the research by Maslow (1943) on human motivation. Consolidating the approach later were theorists such as McGregor (1960); Bennis (1959); and Likert (1967). Like the Scientific-Rational approach, the Human Relations school believed it too had found the one best way to manage and operate organisations effectively. The approach emphasised the following themes:

- The informal and social nature of organisations.
- The importance of considering human needs, attitudes and values.
- The emotional and psychological facets of the worker, not just the rational or economic aspects.

The understanding of change embodied within this approach broadened beyond the restricted Scientific-Rational paradigm, but arguably, the pendulum swung too far the other way. In moving the organisation away from the rational towards the social, changes centred upon human motivation, values, attitudes and behavioural norms. Change activities were concerned with facilitating increased emotional satisfaction. Experimental studies of group dynamics and behaviour led to an understanding of the importance of the softer aspects of organisational change. The famous Hawthorne experiments (see Roethlisberger and Dickson, 1939) highlighted the problems of attempting objective measurement and assessment of change within social systems - an area which change management practitioners continue to grapple with. However, there was still no conception of external change dynamics influencing the organisation from without. Figure 2.2 summarises the Human Relations view of change:

Change focus:	individual performing the job or task
Measurement:	micro variables, soft, qualitative
Driver for change:	individual human needs
Transformation: (*direction*)	rational TO social theory X TO theory Y unmotivated TO motivated unfulfilled needs TO needs satisfied
methodology for change:	scientific, functionalist, planned, reductionist.

Figure 2.2 The Human Relations Perception of Change

In short, change was now perceived as concerned with: human traits, norms and attitudes necessary for effective performance; measurement of soft variables such as motivation and emotional satisfaction; behavioral and psychological aspects of individual/group dynamics *internal* to the organisation.

2.2.3 The Contingency View of Change

During the early 1960's thinking shifted once more, this time away from the notion that there needed to be one best approach to operating and managing all organisations. Instead, several theorists took the view that an organisation's operation and structure was *contingent* upon specific internal and external variables. Namely organisational size, environment dependence and uncertainty, and relevant technology. Prominent advocates of this approach included Katz and Kahn (1966); Woodward (1965); Burns and Stalker (1961); Thompson (1967); Simon (1947); and Lawrence and Lorsch (1967).

The concept of change broadened further under the Contingency approach. It was acknowledged that the organisation existed within an unpredictable environment with which it was interdependent. This adds to the complexity of change dynamics within the organisation. However despite the recognition of the uncertainty associated with external variables, the continency approach remained rational and deterministic in style. Given sufficient understanding of the three key variables, it was believed that all one had to do, was to implement the necessary structural changes to achieve the appropriate balance for smooth, efficient organisational operation. The inherent ambiguity and apparent randomness which characterise perturbations from, and change dynamics within the environment, were still not fully appreciated. As with the Scientific-Rational approach, the idea still persisted that to achieve predetermined goals at some point in the future required the mechanistic implementation of planned change activities. The problem of moving smoothly from point A to point B by achieving prespecified intermediate goals persists today. Point B is either continually moving, and thus harder to reach with a rigid predetermined change plan, or the environment changes significantly in the time it takes to reach B, making B out of date and inappropriate. This issue is captured well in Figure 2.3 - the perpetually failing change management machine. Models of organisational change management based upon the somewhat simplistic assumption that change is merely a carefully planned transition from A to B have appeared more recently, as the work of Beckhard and Harris (1977) and Nadler (1988) demonstrates.

The Contingency Approach acknowledged that there were variables external to the organisation which should influence its internal structure. However, there was still an underlying scientific determinism to the approach which assumed that once these environmental variables had been identified and structural changes made to take account of them, the organisation would operate efficiently and effectively. That the environment was dynamic over time and presented a *continually shifting* set of variables requiring a constant readiness for change, was not fully recognised. Figure 2.4 captures the Contingency view of change:

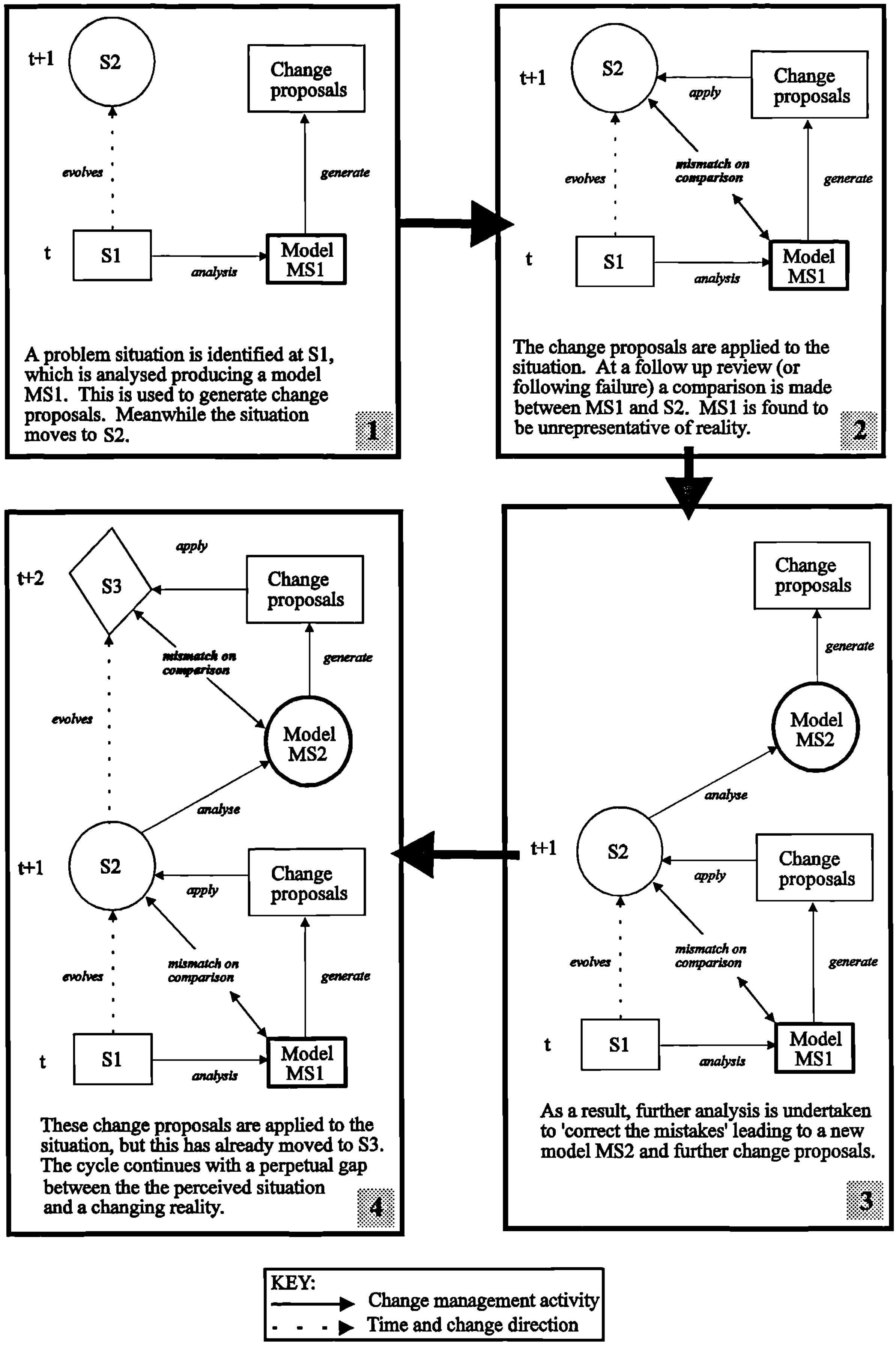


Figure 2.3: Perpetually failing change management machine (adapted from Beckford, 1996 - forthcoming)

Change focus:	organisational structure
Measurement:	macro variables, hard and soft
Driver for change	belief in existence of a best match between organisational structure and environment
Transformation (direction)	unsuitable structure TO appropriate structure ignorance of external factors TO understanding of environmental interdependence
Methodology for change:	scientific, functionalist, planned, reductionist.

Figure 2.4 The Contingency Perception of Change

Figure 2.5 summarises the view and understanding of change on which each of the three approaches are based. As can be seen, common themes which emerged include a belief that organisational change is essentially a *planned* activity, scheduled and implemented in a deterministic and reductionist manner; that the changes were enforced blind to the dynamics of an uncertain environment; that there was a perceived 'best way' or optimum solution which the changes sought to realise; and that change occurred in a sequential manner, and was essentially a one dimensional phenomenon.

2.3 ORGANISATION CHANGE: RECENT DEVELOPMENTS

Since the early 1970's many other approaches and schools of thought have emerged within management thinking and organisation theory regarding change. Figure 2.6 attempts to map out many of these other strands of development. As can be seen, they cover an enormous area. Many of them overlap. Indeed the whole literature can be seen as an interconnected, evolving knowledge set which is constantly being added to. Some are more centred on specific aspects of change, for example information technology design and implementation. Others are concerned with change at a more generic level, such as quality orientated approaches. However what they all have in common is an underlying premise that aspects of an organisation can be *changed* for the better to increase overall performance. Each has its own specific focus, whether it be structure, culture or communication for example.

	SCIENTIFIC - RATIONAL	HUMAN RELATIONS	CONTINGENCY
FOCUS OF CHANGE	Job or task	Person performing job or task	Organisation structure
MEASUREMENT APPROACH	Hard, objective, quantitative, micro level	Soft, qualitative, micro level	Macro variables: hard and soft
CHANGE DRIVER	Maximising behaviour, search for optimal way	Satisfied workers are better motivated and perform better	A 'best match' between the organisation and its environment is achievable
TYPE OF CHANGE	Planned	Planned	Planned
TRANSFORMATION PROCESS (Direction)	Sub-optimal TO optimal Individuality TO shared purpose Discord TO unity Heterogeneity TO standardisation	Rational TO social Theory X TO theory Y Unmotivated TO motivated Unmet need TO fulfilled need	Unsuitable structure TO suitable structure Ignorance of interdependence with environment TO Understanding of environmental dependency
METHODOLOGICAL STANCE	Reductionist, determinist	Reductionist, determinist	Reductionist, determinist
RECOGNITION OF A DYNAMIC ENVIRONMENT AS A CHANGE SOURCE	No	No	Partly

Figure 2.5: View of change from the three paradigms compared

Strands of Organisational Change Thought	**Example Authors (*selected*)**
Adaptation and Evolution	Childs (1972), Miller & Friesen (1980b)
Business Process Change	Kaplan & Murdock (1991), Hammer & Champy (1993), Davenport (1993)
Chaos Theory and Complexity Science	Kiel & Elliot (1995), Stacey (1992), Gaustello (1995), Nonaka (1988), Smith & Gemmill (1991)
Continuous Learning and Self Organisation	Hedberg, Nystrom & Starbuck (1976), Senge (1990), Argyris & Schon (1978), Fortune & Peters (1995)
Creative Management & Innovation	Henry (1991), Flood & Jackson (1991a), Kirton (1980), Morgan (1993)
Culture and Corporate Identity	Schein (1983), Hofstede (1991), Sathe (1985)
Ethics and Values	Hall (1994), Simons (1995), Jacobs (1992), Salomons (1992)
Information Technology Approaches	Martin (1989), Tozer (1985), Scarbrough & Corbett (1992), Bemelmans (1984), Sprague & McNurlin (1993)
Miscellaneous Popularist Approaches	Kanter (1989), Peters & Waterman (1982), Handy (1989)
Organisational Development	Cummings & Huse (1989), French & Bell (1984)
Population Ecology	Hannan & Freeman (1977), Rundall & McClain (1982)
Quality Approaches	Crosby (1979), Deming (1982), Juran (1988), Taguchi (1986)
Phenomenological Approaches	Ranson, Hinings & Greenwood (1980), Zucker (1977)
General Change Frameworks	Lewin (1951), Nadler (1988), Meyer, Brooks & Goes (1993)
Philosophical Paradigmatic Analysis	Burrell & Morgan (1979), Nisbet (1970)
Social Theory	McKinney & Tiryakin (1970), Zald & Berger (1978)
Systems Approaches	
Soft Systems	Checkland (1972), Mason & Mitroff (1981), Ackoff (1981), Churchman (1979)
Systems Engineering and Operations Research	Jenkins (1969), Hall (1962), Daellenbach et al (1983)
Systems Dynamics	Forrester (1971), Wolstenholme (1990), Sterman (1994)
Open Systems	Mullins (1989), Miller& Rice (1967), Scott (1987)
Organisational Cybernetics	Beer (1985), Robb (1985), Espejo (1987)

Figure 2.6: Principal approaches to organisational change

Diagnosing, prescribing, designing and implementing effective change measures is a clear common denominator. Some have a clearly defined theoretical foundation, while others have evolved as operational and practical approaches to organisational change. A detailed and comprehensive review of them all is not possible here, and indeed, is not the purpose of this thesis. There are many ways in which this vast literature can be categorised in order to highlight similarities, differences, common themes and unexplored gaps in the existing knowledge base. Several will be described in the following sections, starting with a review of the three main lines of organisational change theory.

2.3.1 Theoretical Foundations

As Burnes (1992) has noted, organisational change *theory* can be summarised according to three perspectives: Theories of change that focus on the whole organisation or system; those that are based upon the dynamics of groups or teams; and theories that are centred on individual behaviour. These bear many similarities to Allison's three models of decision making (Allison, 1971): different perspectives and explanations of reality, from three different standpoints. (Allison describes the Cuban Missile Crisis through various conceptual lenses, focusing on different units of analysis - leading to different interpretations of and justifications for the events that took place.)

Theories based at the level of the organisation see change originating from two sources: interactions between the sub-systems of which they are composed; and interactions and exchanges of across their boundary with an external environment. Childs (1972) emphasises the latter, proposing three key external factors which may determine the degree of change an organisation undergoes: environmental complexity, variability and illiberality. Zey-Ferrell (1979) proposes three similar classifications: the rate, variability, instability of environmental change. Change analysis and intervention tends to be holistic in nature, with an acknowledgement of synergistic change phenomena occurring at the level of the whole. There have been many proponents of this macro, systemic theoretical view of organisational change, including Parsons (1960), Miller and Rice (1967), Clegg and Dunkerly (1980), Buckley (1968) and Koontz, O'Donnell and Weihrich (1984). While widely supported and firmly rooted in the Contingency school of thought, this perspective of organisational change does have its limitations. Internal change is often seen as reactive, and driven by environmental disturbances in a homeostatic manner. Recent advances in the natural sciences suggest that even inanimate systems do not all respond to external stimuli in such a deterministic manner (some examples will be considered later in the thesis). There is also a tendency to focus on complex cause-effect relationships in attempting to describe and explain organisational change (Butler, 1985), rather than searching for underlying change patterns and emergent themes at the level of the whole. Furthermore, while systems theories of organisational change are able to describe macro change phenomena such as changes in culture, corporate structure or high level business process, they are not so effective in explaining lower level transitions such as changes in individual behaviour or operational procedure.

The second strand of organisation change theory considered here concerns group and team behaviour. Here change dynamics are viewed in terms of group values, norms and roles (Smith et al., 1982) and if change is to be achieved, then according to this view, these group characteristics should be identified and understood prior to attempting planned change. This theoretical perspective on organisational change draws heavily upon the social psychology literature (see for example Swanson, Newcomb and Hartley, 1958). In describing change, a distinction is made between formal and informal groups. Examples of the former include task groups, technological groups, decision making groups, and problem solving groups (Arglye, 1974; Dubin, 1958). Organisational change is seen in terms of interactions, conflicts and relationships between groups, with particular functional or task groups exhibiting cohesive resistance to change (Tajfel and Fraser, 1981; Blau, 1961). However, this strand of organisational change thinking is limited in its ability to describe wider, more macro level dynamics such as technology change. It tends to neglect external and environmental sources of change, and is not fully capable of describing transformations of a revolutionary nature that occur *across* several organisational groupings (for example, corporate downsizing due to market recessions).

Nevertheless, group dynamics based change theories remain a mainstream area of organisational change research as Brown (1988) and Smith (1980) have shown.

The third broad area of organisational change theory is centred upon individual behaviour. Similar to the group based theories, there is an emphasis on understanding individual needs and motivations, in an attempt to unlock human resistance to change. Some theorists take a decentralised view, arguing that individuals are best able to cope with and facilitate change if they are involved and empowered to design and initiate it (Kanter, 1983). Emancipation, participation and ownership are considered key concepts to understanding effective change management. On the other hand, others take a more Scientific-Rational view, arguing that change is best understood in terms of control and manipulation - initiating change by providing specific change sources to reinforce or discourage certain actions or propensities to change (see Porter, Lawler and Hackman, 1975). Whether one takes the empowerment or control stance however, theories of change based upon the individual have been severely criticised because they assume a certain *rationality* about human nature - based on what Schein (1980: 52) has termed rational-economic assumptions. Decisions about the future are invariably based on knowledge from the past, and partial perception of the present. Hence, there is inherent uncertainty embedded within all seemingly rational decisions, as Weick (1969) and Janis and Mann (1977) have observed. Individualist theories of organisational change therefore, have little conception of counter-intuitive, illogical change within human activity systems.

These three strands of theoretical development in organisational change complement each other well, as they each take change as a phenomenon from a different perspective. However, even taken together, they fail to provide a deep, unifying insight into the *nature* and *dynamics* of change within organisations. The group and individual theories tend to err on the side of change management, providing justification for specific change tools, techniques and methods. The organisation/system based change theories can be rather abstract, and difficult to apply practically to the operational realities of day to day business management, as

Beach (1980) has observed. While they are more rich conceptually than the individual and group theories, organisation/system theories are tied principally to the biological organismic metaphor. Other metaphors have come to the fore over the last twenty years, and several are listed the next section.

2.3.2 Classification by Metaphor

Many authors have invoked the use of metaphor over the years to describe developments in organisational theory and management thinking: Thomas and Bennis (1972); Burns and Stalker (1966); Berg (1979); Ackoff (1974); and Pettigrew (1992) to name but a few. The most common metaphors to emerge which describe the underlying characteristics of particular approaches and strategies for organisational change are:

- Machine
- Organism
- Brain
- Culture

An approximate placing of approaches within these four metaphors is illustrated in Figure 2.7. The metaphors span a range of paradigms from the hard, scientific world of the machine to the soft and abstract language of culture.

2.3.3 Classification by Theory-Practice Level

Approaches to organisational change can be categorised according to their theoretical contribution at one extreme, and practical application on the other. In attempting to analyse the many different orientations to patient behaviour change within clinical psychology Goldfried (1980) has suggested several levels of abstraction useful for charting developments in his field. Drawing on this work, and expanding and adapting it for organisational theory and management thinking, gives the following:

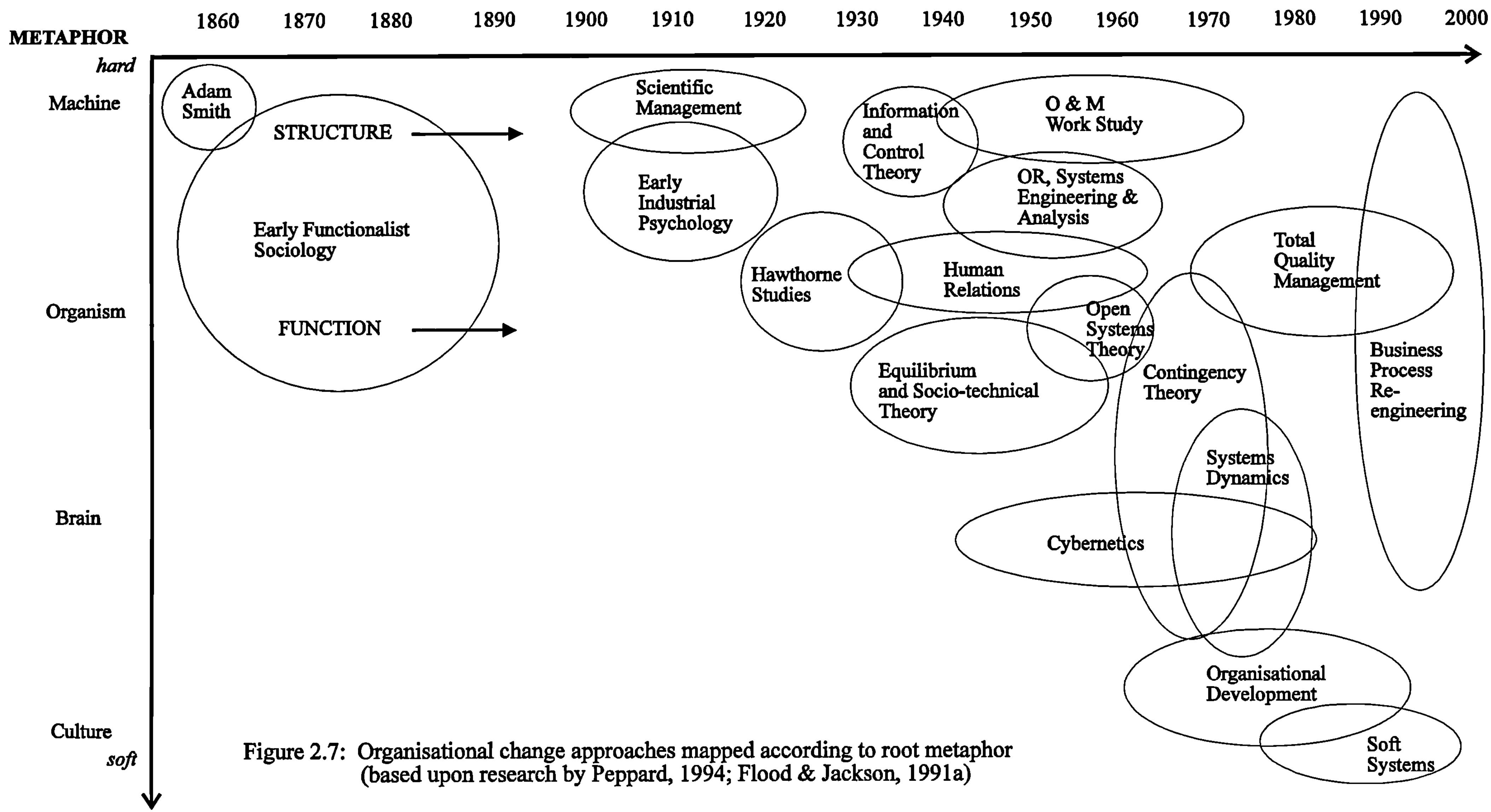


Figure 2.7: Organisational change approaches mapped according to root metaphor (based upon research by Peppard, 1994; Flood & Jackson, 1991a)

Level 1: Theoretical Framework

This is the highest level, offering explanations as to why and how *change* occurs, usually accompanied by a particular philosophical stance. For example the regulation versus radical change debate described by Burrell and Morgan (1979) as two contrasting sociologies underpinning different organisational paradigms.

Level 2: Guiding Heuristic

This describes the underlying 'rules of engagement' and represents the practical manifestation of the change philosophy of Level 1. For example: point of stakeholder involvement; process or function orientation; autocratic or consensus based decision making.

Level 3: Collective Strategy

The generic methodological approach being followed during change activity. This can often be an umbrella level for a range of different change techniques and methods - as under Level 4 described below. For example: Information Engineering; Interactive Management (Warfield and Cardenas, 1993); Total Quality Management; Business Process Re-engineering.

Level 4: Change Technique/Procedure

Specific tools and techniques for change management which may or may not be part of a particular collective strategy at Level 3. For example: structured interviewing; Nominal Group Technique; process mapping etc.

Goldfried discusses the possibility of identifying useful commonalities and the potential for consensus between approaches at different levels within the field of clinical psychology. It is doubtful whether any such consensus of approach could be achieved amongst organisational change theorists and practitioners at Levels 1, 3 and 4. However, within Level 2 there is considerable potential for agreement and cooperative research. Figure 2.8 is an attempt to place the approaches to organisational change listed earlier across the four levels. The classification is somewhat general and some of the specific placings may be debatable. Nonetheless,

Strands of Organisational Change Thought	Theoretical Framework	Guiding Heuristic	Collective Strategy	Technique Procedure
Adaptation and Evolution	*	*		
Business Process Change			*	*
Chaos Theory and Complexity Science	*			
Continuous Learning and Self Organisation		*		*
Creative Management & Innovation			*	*
Culture and Corporate Identity				*
Ethics and Values				*
Information Technology Approaches				*
Organisational Development			*	*
Population Ecology	*	*		
Quality Approaches		*	*	*
Phenomenological Approaches		*		
General Change Frameworks	*			
Philosophical Paradigmatic Analysis	*	*		
Social Theory	*	*		
<u>Systems Approaches</u>				
Soft Systems	*	*	*	*
Systems Engineering and Operations Research		*	*	*
Systems Dynamics			*	*
Open Systems	*	*		
Organisational Cybernetics	*	*	*	

Figure 2.8: Classification of approaches: theory - practice orientation

it can be seen that most of the organisational change approaches are not fully represented at all four levels. This is because very few of them have been explicitly defined and consciously documented at each level, but have emerged and evolved over time as organisational thinking has developed. For example, Business Process Re-engineering currently exists at Levels 3 and 4. Systems thinking approaches to organisational change fare better, with for instance Management and Organisational Cybernetics achieving coverage at Levels 1, 2 and 3 with a growing commitment to 4 (see Beer 1981, 1985; Robb 1985; Ashby 1960, Espejo & Schwaninger, 1993). Of particular note is the number of approaches which lack significant research at Level 1.

2.3.4 Classification by Focus

Another way by which change approaches can be analysed is by the specific focus each takes. There are many aspects of organisational life which could be targeted, for example:

- *Technology*: Information technology and business system implementation
- *Human*: Employee/culture focused change programmes
- *Process*: Work flows and cycles
- *Function*: Operation specific functions and structures
- *System*: Organisation wide change activities, focusing on the viability of the organisation within its environment.

These focus categories are by no means all encompassing and they do not reflect different levels of change activity. However, they do provide a initial broad brush classification of many organisational change approaches, as Figure 2.9 illustrates.

2.3.5 Other Miscellaneous Classifications

Conner and Lake (1988) have distinguished between objects, methods and strategies of organisational change as one way of categorising the literature:

Strands of Organisational Change Thought	Technology	Human	Process	Function	System
Adaptation and Evolution				*	*
Business Process Change	*		*		*
Chaos Theory and Complexity Science			*		*
Continuous Learning and Self Organisation		*	*		*
Creative Management & Innovation		*	*		
Culture and Corporate Identity		*			
Ethics and Values		*			
Information Technology Approaches	*				*
Organisational Development		*			*
Population Ecology				*	*
Quality Approaches		*	*	*	
Social Theory		*			*
Systems Approaches					
Soft Systems		*	*		*
Systems Engineering and Operations Research	*			*	*
Systems Dynamics			*		*
Open Systems			*	*	*
Organisational Cybernetics				*	*

Figure 2.9: Organisational change approaches - classified by focus

<u>Object</u>:	<u>Methods</u>:	<u>Strategies</u>:
Individual tasks	Technological	Facilitative
Organisational processes	Managerial	Informational
Strategic direction	Structural	Attitudinal
Organisational culture	Human	Political

Goodman and Kurke (1982) have proposed that the literature can be analysed according to recurring themes, and have proposed the following scheme:

- o Methods of intervention
- o Large scale multiple system interventions
- o Assessment of change including: - Models of assessment
  - Techniques and instrumentation
  - Analytical procedures
- o Analysis of failure
- o Level of theorizing

Goodman and Kurke also suggest that making a distinction between what they term *planned change* and *adaptation* is a useful means of sorting the multitude of approaches to organisational change. The former relates to specific premeditated internal change programmes within a given environment; the latter to changes which keep the organisation viable and in harmony within a changing environment.

Organisational Development theorists such as Blake and Mouton (1983); French and Bell (1984); Schmuck and Miles (1976); and Harrison (1970) have proposed several typologies for classifying intervention and change approaches, with categories such as

- o Unit of change (individual; group; corporate...)
- o Depth of intervention (strategic; operational; personal...)
- o Focus of intervention (goals; structure; expectations...)
- o Mode of intervention (prescriptive; confrontational...)

Typographical work like this is useful in distinguishing between the intervening 'change maker' and the target of the change. However, much of the Organisational Development literature is based upon techniques and methods for the practitioner (see Huczynski, 1987).

This section has attempted to provide a broad overview of the organisational change literature. More detailed historical accounts can be found in Goodman (1982); Zaltman & Duncan (1977) and Porras and Robertson (1987). Many of the approaches, techniques and methods summed up in Figure 2.6 have been taken up and applied by organisational change practitioners with a good measure of success. However, in much of this applied research and methodological development there is a distinct emphasis on the *how* question: specifically, how to initiate, manage, plan for, react to, implement and control change as a phenomenon - whether it be internal or external to the organisation. As the next section demonstrates, the fundamental essence and character of change as a phenomenon within organisations has yet to be rigorously explored and understood.

2.4 THE PROBLEM HIGHLIGHTED

Vickers alluded to the need for such a basic understanding of the nature of change when he said:

> "The view of entities as both systems and constituents of systems raises intriguing questions about identity and continuity. When does something, or somebody, retain its identity and continuity through change ? When by contrast does it cease to be its old self and either vanish or become something new or different ? The question is not frivolous or merely metaphysical but may be of great practical concern."
> (Vickers 1980a: 20)

Practitioners may point to the apparent success of certain well established applied research techniques and strategies for dealing with organisational change like Soft Systems Methodology (Checkland, 1972), and query why such fundamental questions need to be asked at all. However, as Golembiewski, Billingsley and Yeager have observed: "There is a truism about applied research that an inadequate concept of change leads to diminished or misguided applied research." (Golembiewski et al, 1976: 133).

As has been noted, theorists have historically viewed change within organisations mainly in terms of *planned* interventions, up until the late 1960's. Even with this somewhat limited view of change, several writers noted the uneasy relationship that existed between theoretical researchers and practitioners: "We seem, quite often, to become lost at the crossroads of a false dichotomy; the purity and virginity of theory on the one hand and the anti-intellectualism of some knowledge-for-what adherents on the other." (Bennis, Benne and Chin, 1970: 4). It would seem that in the intervening years, we have passed this crossroads, having chosen to tread with vigour the practical path - down which we are now making great strides. Sadly, relatively few have ventured out upon the theoretical path. Bennis et al. go on to say:

> "It would be desirable to be able to justify our definition of planned change by *carefully researched knowledge of processes of changing*. But, for the most part, this research base has yet to be developed. We hope and believe that it will develop in the future." (Bennis et al., 1970: 61 - italics added)

In a similar vein, Clarke and Ford writing around the same time bemoaned the lack of theoretical endeavour: "...such scholarship and research as does exist is primarily directed to the needs of the action oriented social scientists promoting planned organisational change....published accounts are written for either administrators or consultants." (Clarke and Ford, 1970: 29)

As the thinking about change broadened during the 1970's and other strands of organisational change research developed with the rise of the biological and other metaphors, the '*what is change*' question remained for the most part unexamined. While exploring the concept of change within organisations Berg (1979) came to the conclusion that the task of understanding the nature of change had been neglected as an area of research. He argued "....that much of the present confusion and ambiguity in the field stems from the fact that we actually know very little about the nature of change." (Berg, 1979: 19).

March (1981) also highlighted the weak theoretical base of the organisational change literature at that time. In his discussion of broad theoretical notions about organisation action, he states that "...a comprehensive development of managerial strategies...requires a more thorough understanding of change in organisations, *not a theory of how to introduce any arbitrary change.*" (March, 1981: 575 italics added). Here again we see concern expressed at the apparent over emphasis on answering the *how* question. More recently Morgan (1986) has identified the need for a deeper comprehension of the fundamentals of change. He argues that "...we need to try and understand how the discrete events that make up our experience of change are generated by a logic unfolded in the process of change itself." (Morgan, 1986: 267). His work will be examined in more detail later.

It is the contention of this thesis that an adequate understanding of the fundamentals of change has yet to emerge. Conceptually, the phenomenon of change is still little understood. As Wilson (1992: 3) recently lamented, "...much of the current vogue in management theory is for delineating the steps through which successful change can occur...". He goes on to highlight the explosion of such *change recipes* "...which have little empirical or theoretical foundation [and] should give cause for grave concern amongst all who work in organisations of every type." (Wilson, 1992: 120).

Various calls then have been made over the years right up to recent times, for greater attention to be given to understanding the *nature* of change. These appeals have largely been made in the conviction that organisational change practice would benefit considerably from such research. It would however, be unfair to say that they have gone totally unheeded. Attempts have been made to explore the phenomenon of change as it is manifested in organisations. Some of these will now be examined briefly.

2.5 SOME TENTATIVE BEGINNINGS

One of the most influential attempts to describe the phenomenon of organisational change was the Force Field approach of Lewin (1947; 1951; 1958). According to this, changing some aspect of an organisation involves manipulating the social forces which influence it. This is done in three stages: unfreezing the current state, moving to the new state and finally, re-freezing at the new state. The metaphorical use of a change phenomenon from the natural sciences is of particular interest here, offering a conceptual richness which has inspired many authors to develop Lewin's work further (see for example Brager and Holloway, 1992; Zand and Sorensen, 1975; Rubin, 1967; Kahn, 1974; Schein, 1964). This suggests that the natural sciences have much to offer the organisational theorists - a point which will be explored in detail in Chapter 3.

Bennis (1963; 1966a; 1966b) discussed three approaches to planned change each of which embodies a different change perspective, but are all focused on behaviour and are arguably influenced by the Human Relations orientated thinking of the day. The first is based upon a system of opposing forces which dictate the energy available for a given change, and has its roots in Lewin's work. Change is enabled via tension reduction. This approach is called the Equilibrium Model and is based upon the research of Sofer (1961) and Jaques (1951) amongst others. The second approach views change in terms of reconstructing mental models, in a manner not unlike that outlined by Senge (1990) and the organisational learning approaches to change. The means of achieving mental model change however, is different. Cognitive maps are altered via a process of power redistribution within the organisation involving the promotion of openness and trust through participation in laboratory and T-Group exercises. Examples of this approach include the work of Shepard and Blake (1962). It was described by Bennis as the Organic Model. The third approach views change in terms of the interrelationships between individuals. The underlying premise here is that enhancing interpersonal competence is essential to effective organisation. This was labelled the Developmental Model and is exemplified by the work of Argyris (1962).

In outlining 'processual analysis' of organisational change strategies, Van de Ven has defined change as "...an empirical observation of differences in time on one or more dimensions of an entity." (1987: 331). His conception of change is closely associated with the passage of time and physical observation. Expanding this definition further, he says:

> "Mobility, motion or activity in themselves do not constitute change, although each is in some degree involved in change. Certain dimensions or categories of an entity are the objects being transformed. Change without reference to an object is meaningless." (Van de Ven, 1987: 331).

Here we see an attempt to define change by describing what it is not, and this is a useful start in placing broad limits around the concept. He goes on to draw a distinction between this definition of change identified by direct empirical observations over time, and the *process* of change. The latter he argues can only be indirectly perceived as "...conceptual inferences about the temporal ordering of relationships among observed changes." (Van de Ven, 1987: 331). Conner and Lake allude to a similar distinction, highlighting the difference "...between change as a phenomenon, and changing, as a set of actions." (Conner and Lake, 1988: 7).

Glick, Huber, Miller, Doty and Sutcliffe (1990) have attempted to define change at an operational level in pragmatic terms. Their work is concerned with "...the process of reducing open-ended descriptions of change into a parsimonious set of attributes for theory testing and building." (Glick et al, 1990: 305) They describe four such attributes: the type of change, ie: whether it is designed or not; the impetus for the change, ie: was it proactive or reactive; the ability to distinguish ongoing processes from discrete change events; and the relative importance of the changes - determined by value judgements made by the participants. Ferlie and Pettigrew (1990) in a similar vein, highlight another four attributes, discussing change in terms of speed, quantity, process and quality.

March (1981: 575) has examined a range of factors which he suggests, must be considered in any investigation of the "...fundamental adaptive processes by which change occurs...". He argues that theories of organisational change must: not be based upon simple responses to specific forces such as economic and demographic factors; be capable of encompassing both change and stability; and accommodate the surprise, non-linear aspects of change. However, having laid these useful ground rules, he does not take them further.

As mentioned earlier, within the social sciences Morgan (1986) has realised the need for a more profound understanding of the concept of change. He examines the organisation through what he terms the metaphor of flux and transformation, considering how organisations may exist within deep structures and processes which possess their own *logics* of change. He proposes three such 'logics' and discusses them in detail. The first has to do with self-organisation principles drawn from biology, such as autopoiesis - the ability of an organism to continually renew itself whilst maintaining structural integrity and identity. Secondly he looks at concepts of mutual causality taken from cybernetics, such as interconnected circular loops of positive and negative feedback. Morgan's third logic of change concerns dialectics and the notion of opposites. Here he examines Tao philosophy and the work of Marx as examples of dialectical thinking.

All three logics of change are discussed in the context of organisations, in an attempt to encourage new ways of thinking about and dealing with change. Morgan argues strongly that future research in organisation theory must begin to examine ways to influence the nature of the changes which organisations actually experience, as opposed to just describing and classifying different types of change. This implies a proactive approach to change, which has in part been adopted in recent years by the organisational learning school (see for example Senge, 1990).

Levy (1986) has added to the debate highlighting the distinction that has emerged in the literature between First Order and Second Order change. First Order change is characterised by slow, incremental change that does not challenge the organisations core structure. Conversely, Second Order change is typically radical, multidimensional and revolutionary in nature, altering fundamentally the organisations world view and design. While Watzlawick, Weakland and Fisch (1974) were the first to explicitly describe these two types in detail, various writers on organisations have identified some of the basic characteristics of each:

Author	First Order Change	Second Order Change
Vickers (1965)	Executive change	Policy making change
De Bono (1971)	Vertical change	Lateral change
Greiner (1972)	Evolutionary change	Revolutionary change
Putney (1972)	Linear quantitative changes	Non-linear qualitative changes
Argyris & Schon (1978)	Single loop learning	Double loop learning
Sheldon (1980)	Normal change	Paradigm change

(Adapted from Levy 1986: 8)

This distinction is a useful one in that it highlights two very broad sets of defining attributes for change, and uncovers some of the dynamics perceived to be operating at deeper levels that often go unrecognised. Lundberg (1984) has observed however, that there is a dearth of suitable analytical frameworks within which to develop the concept of Second Order change further. Krovi (1993) has added to the taxonomy by introducing the concept of Middle Order change in discussing information technology and organisational change. This sits somewhat uneasily between Levy's two categories: "Middle order change represents a compromise; the magnitude of change is greater than first order change, yet it neither affects the critical success factors nor is strategic in nature." (Krovi, 1993: 331). More recently, Bartunek and Louis (1988) have explored the theoretical roots of the distinction, illustrating it with examples of change behaviour; and Torbert (1989) has argued that First Order changes within organisations are often planned, while second order transformations tend to be unplanned and unpredictable.

More recently, Meyer, Goes and Brooks (1990; 1993) have taken the concepts of First and Second Order change and applied them at two levels: that of the organisation and the industry in which it exists. This produces a two by two matrix, illustrated in Figure 2.10, within which they classify various approaches to incremental and radical change. Their work clearly distinguishes between the *mode* of change (First or Second Order) and the *level* at which the change is manifest

	First Order Change	Second Order Change
Firm Level	ADAPTATION Focus: *Incremental change within organisations* Mechanisms: - *Resource dependence* - *Strategic choice*	METAMORPHOSIS Focus: *Frame breaking change within organisations* Mechanisms: - *Strategic reorientation* - *Life cycles*
Industry Level	EVOLUTION Focus: *Incremental change within established industries* Mechanisms: - *Institutional isomorphism* - *Natural selection*	REVOLUTION Focus: *Emergence, transformation and decline of industries* Mechanisms: - *Environmental Partitioning* - *Quantum speciation*

Figure 2.10: Mode and Level Orgainsational Change (adapted from Meyer et al, 1993)

(industry or firm). They also recognise that modes and levels of change are fundamental concepts found in both the natural and physical sciences.

Pettigrew (1990ab) argues there has been an over emphasis with prescriptive writing in the literature, leading to under concern with descriptive analysis and conceptualisation. He highlights the contextual nature of change within organisation theory, emphasising:

1. "...embeddedness, studying change in the context of interconnected levels of analysis."
2. "...temporal interconnectedness, locating change in past, present and future time."
3. "...the need to explore...how context is a product of action and vice versa..."
4. "...causation of change is neither linear nor singular"
   (Pettigrew, 1990a: 269)

Pettigrew's research identifies the need to study change across different levels of analysis and different time periods, and goes a considerable way towards refuting the simplistic, one dimensional and discontinuous view of change within early management and organisational thinking. He believes that each researcher should define what they mean by change within their own theoretical framework, thereby emphasising the particular facet of change upon which their theory is focused.

Smith (1982) has attempted to analyse some of the philosophical problems that cloud our thinking about organisational change. He comes to the conclusion that an organisation consists essentially of "...relations among parts and relations among relations..." (Smith, 1982: 318) Therefore any concept of organisational change must be founded upon changing *relationships*. These he argues, can only be altered by changing the metaphors, analogies and metonymies used to describe them. He discusses the notion of boundary as the place where change occurs, and emphasises that it too is a relation, and not part of the structure of the organisation. Drawing heavily on the language of biology and other life sciences to explore the concept of change, he makes a clear distinction between the rules which govern internal structure changes, and those which determine changes of order at the level of the whole.

Gersick (1991) has attempted to explore the nature and dynamics of evolutionary and revolutionary change. She discusses the concept of *deep structures*: fundamental choices and resource configurations which shape organisation structure and environmental interaction. These she argues represent fundamental drivers and controllers of change within organisations, which can lie hidden and often unrecognised. Her work is examined further as the thesis develops.

Golembiewski et al. (1976) have made the important link between the perception of change and how we measure it. They propose three broad classifications:

> **Alpha change**: variation within a given state as measured by an instrument whose calibrations remain fixed.
> **Beta change**: variation within a given state where the intervals of calibration on the measuring instrument have shifted.
> **Gamma change**: a complete change of state as opposed to variation within a given state, making the use of measurement instruments from the original state inappropriate.

They argue that these different types of change have serious implications for designing, assessing and interpreting organisational change interventions. Specifically, they suggest that gamma changes are the most prevalent in organisational development interventions. Aware of the problems in trying to distinguish between the three types of change, they describe various statistical techniques for identifying evidence of gamma change in organisational change projects. Two of their conclusions are worth noting:

- Many studies assume that only alpha change is relevant to organisations, and make no distinction between different types of change.

- o The measurement and interpretation of organisational change interventions "...is chancy in the absence of knowledge about types of change, which is seldom available." (Golembiewski et al 1976: 153).

While acknowledging that there remains much further research to be done in this area, their contribution represents a significant attempt to explore the nature of change, by asking '*what* kind of change is being measured' before tackling the problem of *how* to actually measure it. Other writers have explored their taxonomy further and attempted to apply it as a measurement framework during change interventions: see for example Zmud and Armenakis (1978) and Terborg, Howard and Maxwell (1980).

Miller and Friesen (1980a) have sought to identify various archetypes of organisational change, focusing on the *transition* processes organisations undergo in adapting to their environment. They define a transition as "...a package of changes that occur between the onset of the imbalance or stress and the time when some equilibrium or tranquil interval is reached." (1980a: 271). Their study of the histories of thirty six firms led them to propose nine archetypes of organisational transition: entrepreneurial revitalization; consolidation; toward stagnation; toward centralisation, boldness and abandon; maturation; trouble shooting; fragmentation; initiation by fire; formalisation and stability. While these categories represent particular modes of adaptive behaviour in response to environmental disturbances, they do provide an insight into the cause-effect aspect of change. That is, they describe some of the common patterns of change which emerge in given scenarios, and reoccur over time.

From their analysis, Miller and Friesen argue that there do not seem to be many common transition types and as a result, conclude that "...it might eventually be possible to discover the fundamental building blocks or response behaviours constituting the elementary dynamics of change." (Miller and Friesen, 1980a: 288). Their conception of organisational change is somewhat similar to that of Greiner (1972) and Gersick (1991): general stability with minor adaptation for most of the time, punctuated by periods of acute instability - enabling revolutionary transitions to take place which help maintain viability.

Stacey (1992; 1993) identifies three distinct types of change: *closed*, *contained* and *open-ended* change within organisational systems. These apply to what he terms equilibrium, near to equilibrium and far from equilibrium systems respectively. Closed change is considered predictable and deterministic in the Newtonian sense and governed by specific cause-effect chains. He quotes changes within the popular music market as an example, with demand and supply moving within known limits. Contained change relates to situations where prediction is only possible based upon laws of probability. Because the system is near equilibrium, certain underlying cause and effect chains can be identified which produce regularity. However due to the variability of the environment, elements of irregularity result in behaviour which is not completely deterministic or predictable. Continuing Stacey's organisational example, this corresponds to changes in trends and patterns identified through market research activities for specific types of product. Open-ended change is described as being typified by ambiguity and uncertainty, where "...it is not possible to predict long-term consequences because the connections between cause and effect are lost in the detail of the interactions that occur over time." (Stacey, 1993: 251). He suggests diversification or company mergers as examples of open ended change, because the long term consequences are inherently unknowable due to the complex interdependence of the environmental variables involved. Stacey then, uses *predictability* over the short, medium and long term as a means of classifying change within organisation.

Woodman (1989) has proposed a "combined paradigm" approach to the analysis of change aimed at identifying the factors which produce change in organisations and subsequently evaluate and describe the transformation. The approach is based upon a blending of quantitative and qualitative measurement and intervention techniques, and attempts "...to continue to push out the boundaries of 'normal science' as it pertains to acceptable research on organisational change phenomena." (Woodman, 1989: 175) While convinced that a combined paradigm approach is essential if organisational change is to be better understood as a phenomenon, Woodman admits that he is unsure how quantitative and qualitative approaches could be brought together in practice, and does not progress his ideas further.

2.6 EARLY BEGINNINGS SUMMARISED

Clearly then, some efforts have been made to define and explore the nature of change within organisations. The foregoing does capture some of main themes which have been examined so far. These tentative beginnings contain three main strands of research:

Definition Research: Here, researchers have sought to define and describe the notion of change. For some this has been merely a shallow statement before moving on to expound ways in which change can be achieved - for example: "Change afterall, is only another word for growth, another synonym for learning." (Handy, 1989) - an illustration of how the conceptual aspects of change can be neglected. Others like Van de Ven (1987) discussed earlier have tried to be more theoretical and scientific in their definition of what change actually is. The work of Golembiewski et al (1976), Ferlie and Pettigrew (1990), Glick et al (1990) and Smith (1982) can also be described as *definition research.*

Classification Research: This work covers those who have attempted to identify different types and forms of change phenomena within organisations, placing them in categories according to attribute and characteristic. For example Levy (1986); Krovi (1993); Stacey (1992); Miller and Friesen (1980a) and Meyer, Goes and Brooks (1990; 1993).

Metaphor Research: Here are grouped attempts to explore the nature of change within organisations, which have made extensive use of metaphor. It is important to distinguish between the use of metaphor as a tool for effective design, diagnosis and prescription, and metaphorical thinking as a tool to assist description and explanation. At a conceptual level, the work of Morgan (1986), Lewin (1938; 1951), Gersick (1991), Meyer et al (1993) and Smith (1982) are concerned with the latter. Examples of the former include the perpetual matrix organisation of Bartlett and Goshal (1989), the self-renewing organisation of Hedberg, Nystrom and Starbuck (1976), the self-designing organisation of Nonaka (1988), the cybernetic approach of Beer (1981; 1985), the network organisation of Miles and Snow (1986) and the work of Miller and Friesen (1984).

2.7 SUMMARY AND CONCLUSIONS

This chapter has highlighted that change is an important and increasingly significant phenomenon. Within organisations, it was only ever considered by most theorists and practitioners up to the early 1970's, in terms of planned interventions. The role and influence of the environment was largely unacknowledged. Since then, a host of prescriptive approaches and methodologies for achieving organisational change have been conceived, with due recognition being given to the role of the environment, as well as unplanned change dynamics. However, in the main these have been prescriptive and concerned with *how* to manage change. Little research effort has been devoted to exploring *what* change is as a phenomenon within organisations. The three main areas of organisational change theory have been considered, focusing on the organisation/system, team/group and individual respectively. However, even taken together these do not provide a deep, coherent framework for change analysis.

Clearly, a better conceptual understanding of the nature and dynamics of change would benefit and assist existing change management practitioners, as well as those developing future prescriptive methodologies and approaches. Nonetheless, some theoretical research has been undertaken to examine the nature of change within organisations and social systems. The principal contributors have been reviewed and categorised in terms of their efforts in defining change as a concept; classifying change phenomena by type, form and attribute; and exploring change through the use of metaphor.

To take all this work forward however, and gain a more complete understanding of change, a multi-disciplinary approach is called for. Change is a phenomenon which occurs across the disciplines. Specialists from different knowledge domains have their own language, concepts and theories for describing and explaining it. Exploring what other subject areas have to say about the nature of change and abstracting any potentially useful theoretical insights they may offer at a generic level, could lead to a greater understanding of change within organisations. Chapter 3 outlines such an approach.

CHAPTER 3

THE APPROACH DESCRIBED

General Systems Theory Revisited

> *"...a cosmopolitan outlook in theorising depends upon the theorist leaving at some stage, the community of practitioners with whom he or she may feel at home, to appreciate the realms of theorising defined by other paradigms, and the varieties of metaphors and methods through which theory and research can be conducted."*
>
> (Morgan, 1980: 607)

3.1 INTRODUCTION

This chapter describes the cross disciplinary approach that was taken to explore the phenomenon of change. It begins with a description of General Systems Theory (GST), and how it can be employed to explore and unite common themes from across a range of knowledge domains. This is followed by an explanation of the GST style approach which was adopted for this thesis. Some examples of organisational theorists who have looked beyond the confines of their own discipline are given, to illustrate further the power and creative potential of taking a cross discipline approach during research - regardless of the phenomenon under investigation. The chapter concludes with a brief summary of the main points.

3.2 GENERAL SYSTEMS THEORY REVIEWED

General Systems Theory (GST) is founded upon the notion that homologies and isomorphisms exist between different subject domains (Waelchli 1992). One of the early proponents of this cross discipline style of thinking was the biologist Bertalanffy (1950; 1962); other prominent writers include Boulding (1956b), Rapoport (1966; 1988) and Gerard (1957). GST can be described as a meta-theory, which seeks to unify science by the drawing together of common principles and laws from different disciplines. Its emergence can be attributed to at least two clear historical reasons.

Firstly, the increasing specialisation of science over the last two hundred years has caused a fragmentation of knowledge, with communication between disciplines becoming ever more difficult as each sub discipline isolates itself further by adopting complex vocabulary and jargon. During the 1950's and early 1960's, there was a growing sense that an integration and unification of science should be attempted in an effort to redress the balance (see Mesarovic, 1964), and a return made to the philosophy of scientific endeavour prevalent during the Renaissance - where physical, natural and social reality was taken and investigated as one glorious ontological whole (Oliga, 1988). Indeed, there have been those throughout history who have possessed such universal interests. Shurig (1986) identifies some of them and notes that they were eager to look outside of their own specialist discipline for inspiration:

> "Aristotle, Leonardo da Vinci, Francis Bacon, G.W. von Leibnitz. Benjamin Franklin and J.W. von Goethe to name but a few.... They strode through specialised disciplines like colonies of marching ants... In our time, Ludwig von Bertalanffy, the originator of GST has demonstrated similar universality of interest, a passion to understand the underlying interrelations and interconnections of things... They lacked the tendency, so characteristic among highly learned and disciplined academics of every age, to methodically filter out of the consciousness those ideas which do not pertain to their speciality, which threaten it in some way, or which go counter to learned, prevailing, and cherished paradigms. (Shurig, 1986: 9)

However, historically, such individuals have always been in the minority. This maybe because their breadth of interest and investigative approach seems rather daunting to the researcher, given the cognitive limits of the human brain. One person can only be aware of but a tiny part of the vast knowledge base that already exists - more true today than it has ever been. Schrodinger foresaw this difficulty, but was not in the least dissuaded by it:

> "We feel clearly that we are only now beginning to acquire reliable material for welding together the sum total of all that is known into a whole; but on the other hand, it has become next to impossible for a single mind to command more than a small specialised portion of it. I can see no other escape from this dilemma (lest our true aim be lost forever) than that some of us should venture to embark on a synthesis of facts and theories, albeit with second hand and incomplete knowledge of some of them - and at the risk of making fools of ourselves." (Schrodinger, 1944: 1)

A second reason for the rise of GST, was the inherent reductionist nature of science generally, and the narrow constraints it placed upon phenomenological analysis. That is, there was a belief that to understand the whole, disassembly of a system's constituent parts and identifying hierarchical cause-effect relationships was all that was necessary. The advent of the biological metaphor (Bertalanffy, 1949), and Gestalt psychology and field theory (see Whitaker, 1965; Katz and Kahn, 1966) began to challenge this assumption.

These two themes provided the necessary catalyst for the birth of GST. Indeed, de Greene speaks of:

> "Pressures to integrate similarities and relationships among the sciences, to enhance communication across the disciplines, and to derive a theoretical basis for *general* scientific education..." (de Greene, 1970: 91 - original emphasis)

While it has had its critics over the years (see Naughton, 1979; Lilienfeld, 1978; Berlinski, 1976) research still continues within the GST movement. It has broadly developed along two lines: formal systems theory and qualitative systems theory. Formal theories are based upon rigorous mathematical formulations and logical definitions of system types, attributes and dynamics. Examples of such work include Klir (1969; 1985), Mesarovic and Takahara (1975, 1988), Nicolis and Prigogine (1977), and more recently some of the work undertaken by the Sante Fe Institute (see Stein, 1989; Zurek, 1990). Qualitative systems theory, on the other hand does not use formal mathematics as a vehicle for system investigation and description, but deals in concepts and qualitative conceptual models as well as metaphor and analogy where appropriate. Examples of work in this area include Corning (1995b), Lasker (1983), McNeil (1995), Robbins and Oliva (1984), Buckner (1995) and Barrow (1991) to list but a few. The doctoral research undertaken here falls into this second category, and the work of Corning (1983; 1995ab) is outlined in the next section to illustrate this type of non-quantitative general systems analysis.

GST remains then, a conceptually insightful approach - a uniting analytical schema within which the artificial boundaries between the sciences can be transcended:

> "GST, even stripped of its substantive laws (though few), has made its mark in the scientific world by providing the framework for viewing complex

phenomena as systems, as wholes, with all their interrelated and interacting parts. Herein lies one of its merits, and its justification."

(Schoderbek, Schoderbek and Kefalas, 1990: 35)

3.3 A GST STYLE APPROACH

The phenomenon of interest for this thesis is change. A GST approach was chosen as a means of investigating it, because it enabled the exploration of change phenomenon across *other* disciplines. In his discussion of GST, one of the movement's founders, the economist K.E. Boulding, outlined a strategy for dealing with what he termed phenomena of *universal significance*. This was:

> "...to look over the empirical universe and pick out certain general phenomena which are found in many different disciplines, and to seek to build up general theoretical models relevant to these phenomena."
>
> (Boulding, 1956a: 199 - original emphasis)

Arguably, change is just such a phenomenon. It is to be found in any discipline which attempts to comprehend the complexity and workings of the world. Thom (1975) refers to it as succession of form:

> "...it is indisputable that our universe is not chaos. We perceive beings, objects, things to which we give names. These beings or things are forms or structures endowed with a degree of stability; they take up some part of space and last for some period of time.... Next we must concede that the universe we see is a ceaseless creation, evolution, and destruction of forms and that the purpose of science is to foresee this *change of form* and, if possible, explain it." (Thom, 1975: 1 - emphasis added)

One of the objectives of this thesis is to develop an approach that would help explain and describe such change of form, from across a wide range of subject domains. An original stated aim of GST was to "...investigate the isomorphy of concepts, laws, and models in various fields, and to help in useful transfers from one field to another..." (Bertalanffy, 1968: 15). In its original context this noble objective is perhaps far more embracing and ambitious than what is being proposed here with regard to change. Nonetheless, there can often be a reluctance to look beyond the confines of one's own discipline for comparable and structurally similar concepts in other subject domains.

One GST theorist who has attempted to do this in some detail is P.A. Corning (1983; 1995ab). He has explored the phenomenon of synergy as it is described across a range of disciplines (see Figure 3.1), highlighting how *synergy* has become an umbrella term:

> "Synergy - the combined effects produced by two or more parts, elements or individuals - is a ubiquitous phenomenon in nature and human societies alike. Although it plays a significant role in most, if not all, of the scientific disciplines, its importance is not widely appreciated because it travels under many different aliases..." (Corning, 1995a: 663)

And so it is with the phenomenon of change, which parades across many subject domains under numerous guises, including transformation, development, metamorphosis, transmutation, evolution, regeneration, innovation, conversion, revolution and transition to list but a few. Sadly, with the continuing and increasing specialisation of science into sub-disciplines, the ability to step back and survey the general field of research endeavour for a given phenomenon is hampered. As Troncale (1985) has remarked:

> "Very often researchers in a discipline have discovered aspects of the isomorphy on their own level or scale and named it in the jargon of their own discipline. When approached about the existence of the isomorphy across disciplines they tend to respond, 'Oh! that's just xxxxxxx. We've studied that for years.' The special features that each isomorphy takes on with each scalar level....obscures the general features it maintains across levels."
> (Troncale, 1985: 188)

It is those *general features* which this thesis seeks to explore with regard to change. Identifying and comparing similar concepts of change from across the disciplines does serve as a useful starting point.

The rise to prominence of Chaos Theory during the 1980's is another example of attempts to describe similar phenomenon across a range of subject domains, as Andersen (1988), Goerner (1994) and others have observed. While not explicitly

DISCIPLINE	EXAMPLE	ASSOCIATED VOCABULARY
Thermodynamics	Dissipative structures	*emergence, low entropy, order/disorder, negentropy*
Quantum physics	Quantum coherence	*ordering, holism*
Physics	Chaotic phenomena	*emergence, attractors, order, interactions*
	Self-organised criticality	*interactions, holism*
	Phase transitions	*symmetry breaking, cooperative effects*
Neurobiology	Neuronal transmission	*threshold effect, cooperativity, emergence*
Biophysics	Hypercycles	*co-ordination, emergence interactions, cooperation*
Molecular biology	DNA	*co-ordination, interaction, complementarity*
Developmental biology	Homeobox complex	*co-ordination, organisation, cooperation*
Biology	Symbiosis	*cooperation, mutualism*
	Co-evolution	*parasitism, interactions, mutualism*
	Sociobiology	*reciprocal altruism, emergence, cooperation*
Biochemistry	Supra-molecules	*functional integration, coordination, interaction*
Chemistry	Molecular macro-structures	*symmetry, order, collective stability*
Anthropology	Cultural evolution	*symbiosis, co-ordination, cooperation*

Figure 3.1: Examples of synergy from across the sciences
(Adapted from Corning, 1995a)

classed as a GST area of research, it does embody some of the GST ideals of cross discipline studies, isomorphic analysis and the search for general theories. The impact it has made upon physical and natural science generally, cannot be underestimated, as the following quotes demonstrate:

> "Fifteen years ago, science was heading for a crisis of increasing specialisation. Dramatically that specialisation has reversed because of chaos."
> (Shlesinger, 1987)

> "...chaos is a science of process rather than state, of becoming rather than being. ....Chaos breaks the lines that separate scientific disciplines. Because it is a science of the global nature of systems, it has brought together thinkers from fields that had been widely separated." (Gleick, 1987: 5)

As a uniting field of study, chaos theory has achieved much, and clearly demonstrates that cross discipline analysis of common or similar phenomena can be highly productive. However, to be productive, the collation and investigation of ideas, concepts and phenomenon must clearly be undertaken in a structured and purposeful manner, as Rapoport (1995: 663) has noted: "Generalisations derived from a juxtaposition of facts are not fruitful unless some conceptual, theoretical scheme guided the generalisations....". The GST philosophy discussed so far constitutes the 'theoretical scheme' underlying this research. The specific methodological steps followed are now described. Figure 3.2 provides a diagrammatic summary of the approach.

3.3.1 Identification of Change Phenomena in Different Disciplines

The natural and physical world offers a multitude of examples of change phenomena over a range of time scales: "Things go slowly for a time and nothing seems to change - until suddenly the eggshell cracks, the branch blossoms, the tadpole's tail shrinks away, the leaf falls, the bird moults, the hibernation begins." (Bridges, 1980: 5) The diversity of such change phenomena is vast, and identifying suitable candidates from a range of disciplines for further investigation, was not easy. Several criteria for selection were used in choosing a sample. These were:

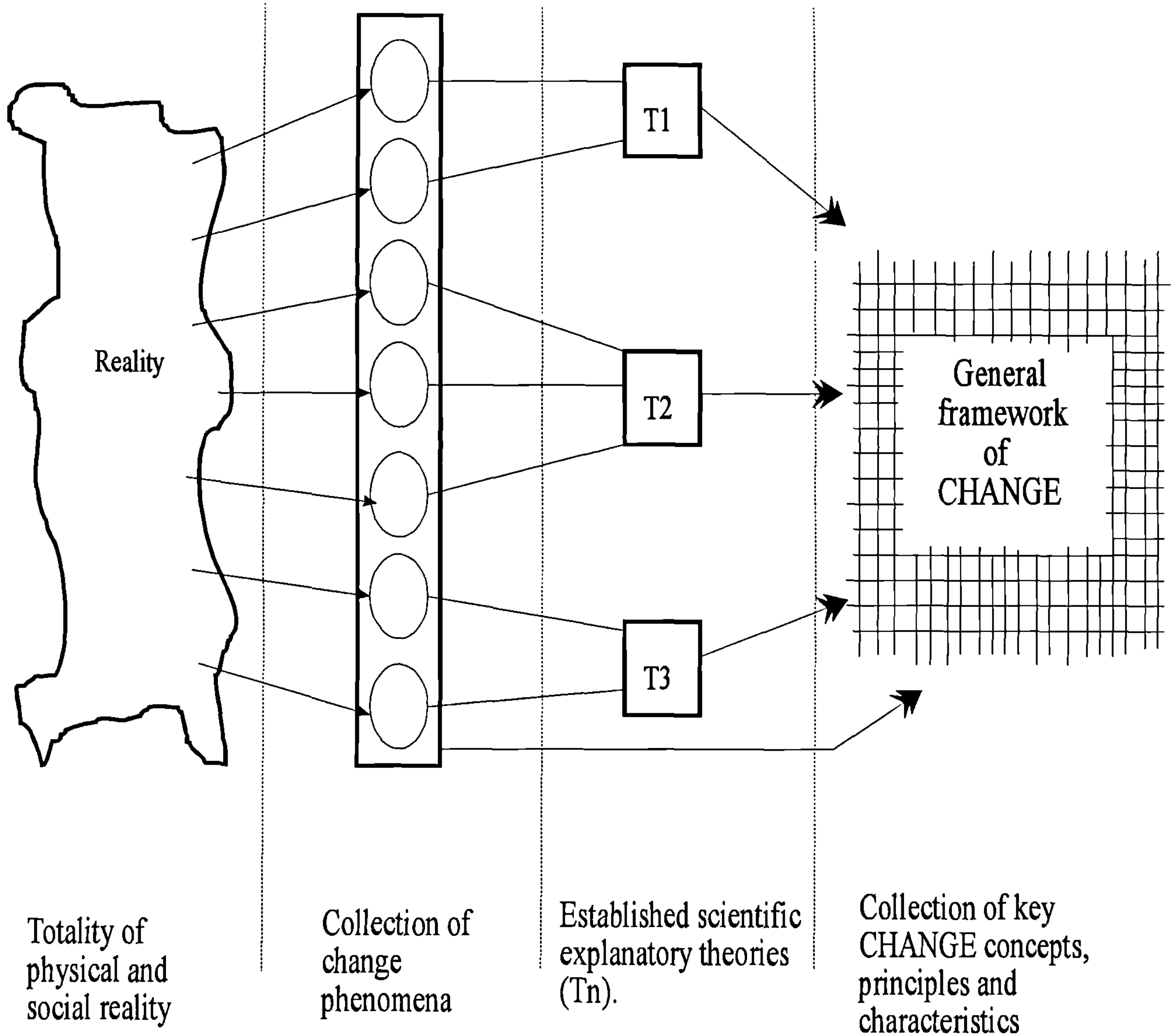


Figure 3.2: The investigative approach summarised

1. Well documented: the phenomenon must be widely discussed and described in the relevant scientific literature.
2. Well understood: there must be established theories which attempted to explain the phenomenon.
3. Understandable by the non-specialist: the phenomenon must not be obscure or wrapped in complex and highly technical language. It must capable of being readily grasped by scholars in other subject domains at a basic conceptual level.

In most cases these criteria were fulfilled. The objective was to select phenomena which were rich enough in description and conceptually deep enough to allow metaphoric and analogic abstraction and reasoning later on. In this respect, comprehension by the non-specialist was of great importance.

3.3.2 Analysis of Source Domain Explanatory Theories

The next stage was to analyse the theories and concepts employed by the relevant scientific community to describe and explain each change phenomenon. This raised a somewhat controversial epistemological issue. A long standing point of discussion within the philosophy of science literature is whether or not observation and description of a given phenomenon can be made independently of pre-existing theory (see Carnes, 1982; Hanson, 1969). The view taken here is that the specialist probably cannot describe a phenomenon within his or her field without seeing it through the lens of prevailing theory. The non-specialist however, perhaps ignorant of the appropriate theoretical language and technical parlance, may be able to perceive and describe the phenomenon in some other way. This alternative account could well offer novel and conceptually useful metaphors and analogies not captured by the more formal theory laden description of the specialist. Contributions then, from those not familiar with the existing theoretical explanations for the phenomenon in question can be of great value, in helping to avoid overlooking any subtle conceptual insights. In this way, both the formal explanations and theories of the original discipline, and the descriptions of the non-specialist can be explored.

In examining various change phenomena, and their explanatory theories, the objective was to reveal similarities in form and process between disparate change phenomena and identify:

- Fundamental principles or themes of change.
- General characteristics and attributes of change.
- Problem issues associated with system intervention to measure or manage change.

These would form the basis for the later development of a general change framework (discussed in Chapter 6).

3.3.3 Compilation of Insightful Concepts, Metaphors and Analogies

The investigation of a range of change phenomena in this manner produced a number of isomorphic concepts, as well as some rich metaphors and analogies. These were of particular interest as they each described different aspects of change, highlighting obscure and often unusual features. While the flux and transformation metaphor of Morgan (1986) discussed earlier (section 2.5), provides a basis for considering different concepts of change, it is rather general. Of more interest here were the identification of specific, well defined metaphors *for* change rather than the collective metaphor of change itself. Metaphorical thinking is becoming well established as an explicit tool with which to study various facets of system behaviour, particularly within organisation theory (Beer, 1981; Tsoukas, 1991); information systems (Walsham, 1991; Merali and Martin, 1994); creative management (Henry, 1991; Van Gundy 1988; Senge, 1990); General Systems Theory (Rapoport, 1988) and Critical Systems Thinking (Flood and Jackson, 1991ab).

The metaphors and analogies which came to light were seen as having two potential uses. The first was to use them, along with the isomorphic concepts identified, as a creative knowledge base from which to draw upon in developing a general change framework. The historical precedent for employing analogical thinking in this way has long been set, as Leatherdale notes:

> "...the basis of progress in science is not an analogical act in the ordinary sense, but an analogical perception which involves the importation of analogues from discrete areas of experience into areas of experience under investigation, with a resultant reformulation or re-ordering of the area under investigation so that hitherto unremarked analogies are seen and novel inferences suggested." (Leatherdale, 1974: 32)

The second use was to apply them direct to the target domain, using them as descriptive and explanatory tools to examine specific organisational change situations. The manner in which this is done will be described in more detail later in the chapter.

3.3.4 Construction of a General Change Framework

Having collected a range of explanations, metaphors and descriptions of change phenomena, the next step was to form them into a generic framework. Here an attempt was made to order and classify the emerging principles, attributes and common themes of change. The objective was to construct a descriptive framework for system change at a generic level, which could later be applied to the target domain of organisations. It was anticipated that the initial utility of such a framework would be its descriptive and explanatory ability - uncovering some of the underlying processes and dynamics of change. However, it was hoped it would also serve as a useful aid for identifying and classifying different types of change according to attribute and characteristic.

3.3.5 Application of Change Framework to Target Domain

Having constructed an initial change framework, the next stage was to apply it within the target domain of organisations. As Figure 3.3 illustrates, it was envisaged that this could be done in several ways:

1. Application to actual 'live' change situations through action research based case studies.
2. Application to historical accounts of organisational change situations described in the literature.
3. Comparison with existing organisational change management methodologies to assess to what extent they embody and reflect the essentials of the framework.

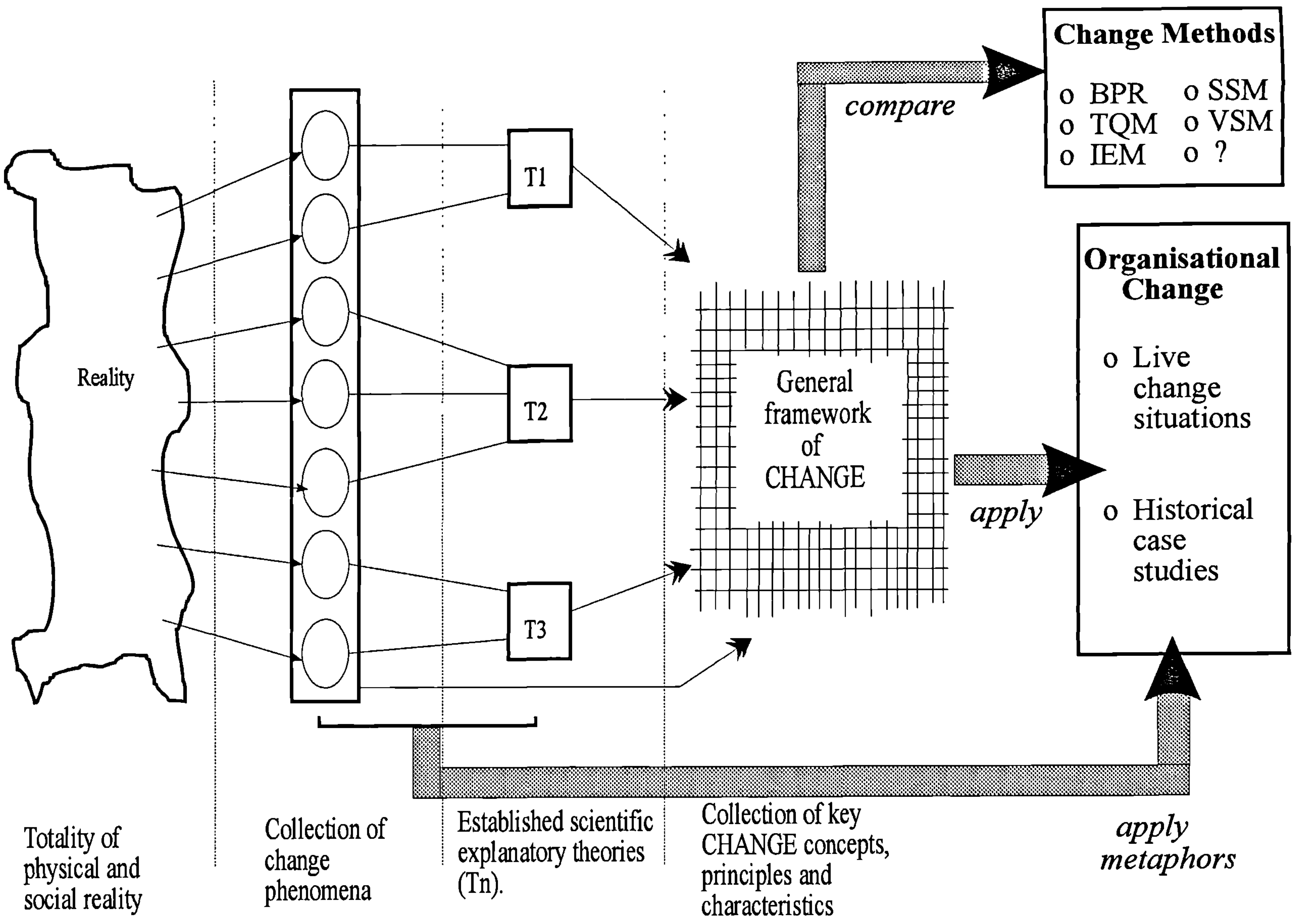


Figure 3.3: The investigative approach applied

Taken together, these three allow the framework to be applied to both existing change methodologies (3) and actual practice (1 & 2). It was considered that for the purposes of this thesis, the first of these would be sufficient to make an initial assessment of the utility and potential of the framework, and the benefits of a GST style approach. To this end, two case studies were undertaken and these are described in Chapters 7 and 8. It is hoped that in the future, the pursuit of (2) and (3) above may provide the impetus for further research beyond this work, once the utility and validity of the approach and initial framework proposed here has been appraised.

It was anticipated that as part of the framework application during the case studies, suitable metaphors and analogies could be applied *directly* themselves (as shown in Figure 3.3). As previously noted, metaphorical thinking is increasingly being used within organisations for problem solving and creative management activities. Individual metaphors can be a very powerful catalyst for change due to the vivid mind pictures they create - capable of dramatically highlighting inadequacies of the old and the advantages of the new, much faster than persistent logical argument:

> "...the act of creative perception in the form of a metaphor...involves an extremely perceptive state of intense passion and high energy that dissolves the excessively rigidly held assumptions in the tacit infrastructure of commonly accepted knowledge." (Bohm and Peat, 1987: 17)

It is this ability of metaphor to 'dissolve' the old and create the new which makes it such a persuasive and powerful tool. As Handy (1989: 14) has stated: "New imagery, signalled by new words, is as important as new theory; indeed new theory without new imagery can go unnoticed." Another reason why metaphor is particularly helpful during organisation analysis, is because like most social sciences, organisational theory and management theory lacks the clinical exactness of description normally associated with the physical sciences. As one observer has noted:

> "We need metaphor in just those cases where there can be no question as yet of the precision of scientific statements. Metaphorical statement is not a substitute for formal comparison or any other kind of literal statement, but has its own distinctive capacities and achievements." (Black, 1962: 46)

Nevertheless, in applying metaphor direct to organisational change situations, a clear method is still required to structure the analysis, and to provide some rigour to the comparison between the source subject domain of the metaphor being used, and the target subject domain of the organisation. Beer (1966; 1984) has outlined a formal method of applying concepts from one subject domain and to another, and it is this method which was taken and adapted to explore change metaphors and analogies when applied to organisations. Figure 3.4 demonstrates Beer's method, illustrating how to build a scientific model of a managerial situation. Modifying his original method, the process of metaphor application used during this research can be summarised in the following steps:

Step 1: Generate an initial change insight between some phenomenon within natural/physical science and a given organisational scenario. This is usually in the form of a metaphor: A is like B due to loose similarities 1, 2, 3.....etc.

Step 2: The metaphor is explored in more detail with a conceptual model being generated for both the phenomenon and the organisational scenario.

Step 3: Explicit one to one relationships between the two models are defined. The purpose of such homomorphic mapping is to eliminate inappropriate aspects of the comparison which do not correspond or are not applicable.

Step 4: Draw out any implications of the analysis for the organisation.

In Beer's original method, he suggests that the two models generated at Step 2 should be as rigorous as possible, incorporating a series of analogical statements which demonstrate how the models are similar. He goes on to propose that they can then be combined into a formal scientific model at Stage 4, using quantitative methods from traditional operations research. From this he suggests that useful deductions may be made which will assist management in their decision making, and enhance their understanding. However, having reviewed documented applications of Beer's method (see Clemson, 1984), it was believed a more qualitative approach would be appropriate, as the purpose here was to gain a deeper *conceptual* understanding of the nature and dynamics of organisational change. Hence the amended four step approach

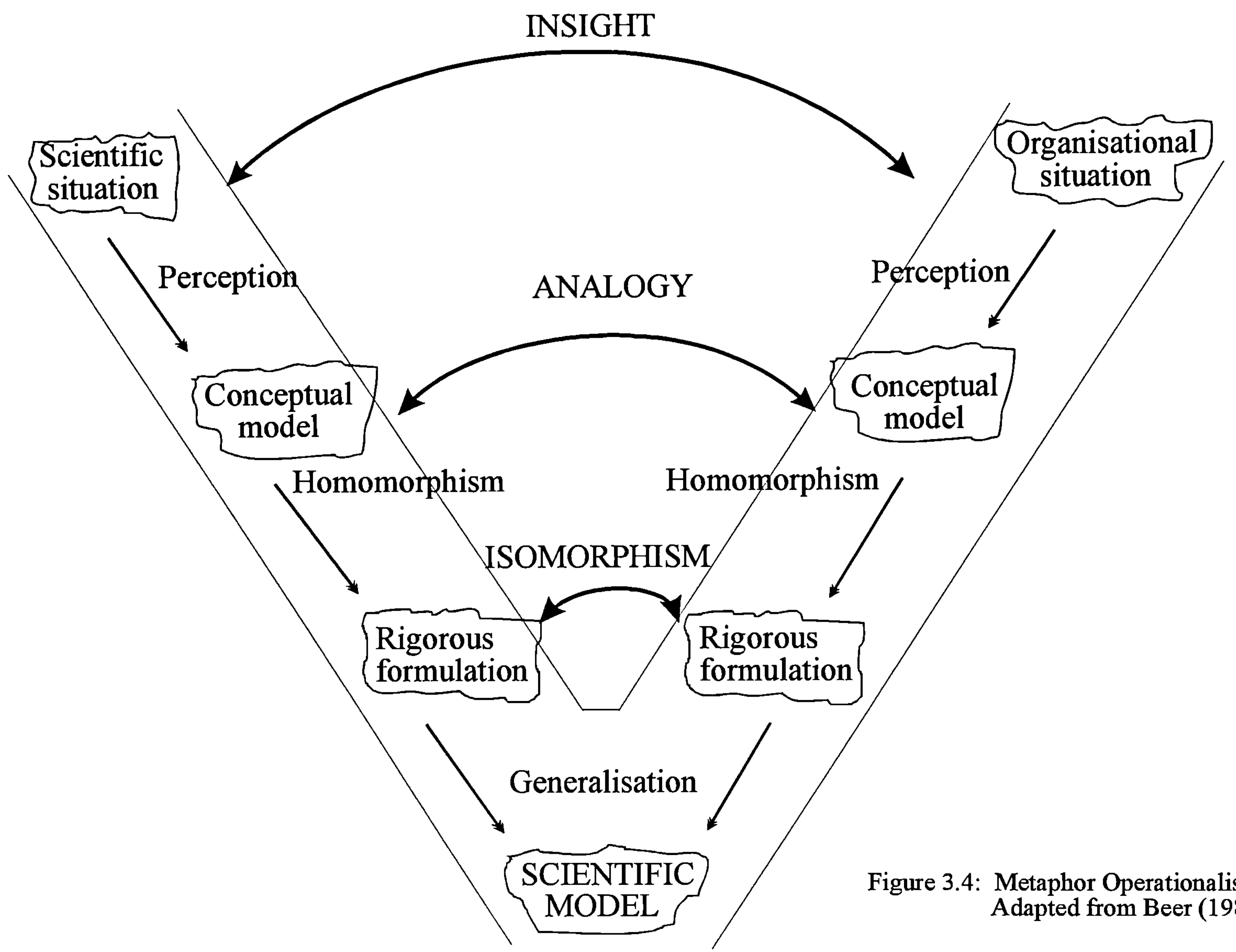


Figure 3.4: Metaphor Operationalisation
Adapted from Beer (1984)

advocated above. An example of how this approach was applied in practice is discussed in Chapter 7, as part of one of the case studies.

3.4 EXAMPLES OF CROSS DISCIPLINE BASED RESEARCH WITHIN ORGANISATIONAL THINKING

Several organisational theorists have attempted to move beyond the confines of their own discipline in search of new ideas and concepts which may benefit their work. Some will be briefly considered here.

The work of Gersick (1991) introduced in the previous chapter (section 2.5), examines the concepts of evolutionary and revolutionary change across six different knowledge domains. These are adult psychology; group behaviour; organisational development; history of science; biological evolution and physical science. Her approach has been to:

> "...juxtapose similar theories from different research domains and to show how each suggests questions and insights for the others. Two premises underlie [the approach]... (1) that there are important commonalities in the way many systems, including human systems, *change* and (2) that we can benefit by comparing research findings from disparate areas because different facets of kindred processes may come into focus as the methodology and level of analysis vary." (Gersick, 1991: 11 - emphasis added)

She examines in detail the phenomenon of change as punctuated equilibrium. Her cross discipline approach is demonstrated in Figure 3.5 and she concludes with three generic questions which she argues, are applicable to any study of organisational systems:

- o Do the results indicate whether the system is in equilibrium or under going change?
- o Is the propensity to remain in stability or undergo transition, a function of the parts of the system, or a function of the forces and deep processes that organise them?

SUBJECT DOMAIN	**Authors Selected**	**Concepts of Deep Structure**	**Concepts of Equilibrium**	**Concepts of Revolutionary Periods**
Individual Adult Development	Levinson (1978; 1986)	*life structure*	*structure building periods*	*transitional periods*
Group Development	Gersick (1988) Gersick & Davis (1989)	*framework*	*learning periods*	*transition period*
Organisational Evolution	Tushman & Romanelli (1984; 1985)	*strategic orientation*	*convergent periods*	*reorientations*
History of Science	Kuhn (1970)	*paradigm*	*normal science*	*scientific revolutions*
Evolutionary Biology	Gould (1977; 1980;1989) Wake, Roth & Wake (1983) Eldredge & Gould (1972)	*genetic programs*	*phyletic transformation*	*speciation*
Self-Organising Systems	Hanken (1981) Prigogine & Stengers (1984)	*order parameters*	*stable regions*	*bifurcation*

Figure 3.5: Exploration of a cross discipline phenomenon: punctuated equilibrium (based on the work of Gersick, 1991)

- To what extent will this *propensity* alter, if the system undergoes a radical transformation?

Tsoukas (1991) has also argued for a cross discipline, structured and more rigorous use of metaphor within organisational thinking. He demonstrates that knowledge is often *stratified*, and that a disciplined imagination is required to reach the lower levels:

> "Mechanisms responsible for experienced events are sought at increasingly deeper strata. In the very beginning of such a 'drilling' process of knowledge acquisition, metaphors may provide the initial insights leading to the hypothesis of plausible causal mechanisms. At subsequent strata, however, metaphorical insights and analogical reasoning need to be transformed into a literal language that expresses real mechanisms and identities."
>
> (Tsoukas, 1991: 572)

He goes on to examine the concepts of isomorphism, metaphor and analogy and how they can be employed to draw upon the knowledge base of other disciplines, in order to enrich the thinking and research within organisational science.

Morgan (1980; 1981; 1983; 1986) has used metaphorical thinking extensively in his analysis of organisations. Drawing from a range of subject domains he explores various facets of organisation life through an assortment of metaphors and pictures. These have been taken from fields as varied as political science, biology, psychiatry and cybernetics. Morgan advocates an openness and receptivity to concepts from other disciplines. Describing his own work in the preface to one of his books he states:

> "Frequently, the discussion ranges well beyond the confines of organisation theory, for the metaphors and ideas considered are drawn from diverse sources. ...it is important to understand that the mode of analysis developed here rests in a *way of thinking* rather than in the mechanistic application of a small set of clearly defined analytical frameworks. While the book focuses on a number of key metaphors that have relevance for understanding a wide range of organisational situations, there are others that can produce their own special insight. Effective organisational analysis must always remain open to this possibility." (Morgan, 1986: 16 - original emphasis)

Subsequent development of Morgan's work by Flood and Jackson (1991a; 1991b) into a practical methodology for metaphor application within organisations, has not stayed loyal to this exhortation to 'remain open'. Flood and Jackson took five of Morgan's metaphors and institutionalised them within a creative problem solving approach called Total Systems Intervention (TSI). These were:

- Machine metaphor
- Organic metaphor
- Brain metaphor
- Culture metaphor
- Political metaphor

However, what was lost in terms of creativity and freedom to draw from other subject domains, was partly compensated for, by providing a practical tool for management to choose an appropriate problem solving approach which best fits their scenario. Having chosen the "dominant" and "dependent" metaphors, an appropriate systems approach is then selected for analysis and implementation purposes. TSI does then attempt to take a cross disciplinary approach to organisational analysis and change, by employing five rich and conceptually insightful metaphors.

Wheatley (1992) has explored several areas of physical and natural science in search of lessons applicable to organisations. She speaks of the need to "...draw from the sciences to create and manage organisations, to design research, and to formulate hypotheses about organisational design, planning, economics, human nature, and change processes..." (Wheatley, 1992: 6). Specifically, she examines aspects of quantum physics, chaos theory, phenomena of self-organisation, and field theory, discussing some of the implications these knowledge domains have for our understanding of organisational behaviour. Her underlying premise is that historically, organisational theorists have been influenced (consciously or otherwise) by the prevailing scientific view of the world and the assumptions embedded within it. With the advent of what she calls the 'new science' - typified by the emergence of disciplines such as quantum mechanics, relativity theory, complexity science and chaos theory - Wheatley argues that organisational theorists and managers need to realign themselves with the new scientific world view, and they principles they contain.

Her work is not specifically aimed at exploring the notion and phenomenon of change. Nor is it the result of a coherent and explicit cross discipline research programme, but rather the gradual accumulation of observations and insights into some of the parallels between the 'new science' and organisational behaviour. Nonetheless, it does represent a valuable attempt to harness the creative potential and conceptual richness offered by recent advances in the natural and physical sciences, and apply them to organisational thinking.

This section has demonstrated that a cross-discipline approach to the study of organisations has already been undertaken by a number of theorists. Several have been discussed. Their work shows that they have not been afraid to venture into other subject domains in search of inspiration. The GST approach advocated in this chapter seeks to complement and build further on this work. An important point to note is how the perceived utility and importance of metaphorical thinking is heightened by such cross-discipline research. In the quest for a greater understanding of discipline specific phenomenon, as soon as one steps outside of one's own subject domain in search of other ideas and concepts, one is confronted with metaphor and analogy. Any approach which does advocate the exploration of several disciplines must address the question of metaphor, and explain how it is to be dealt with, (as has been done here in section 3.3.5). By definition the two are inextricably linked.

3.5 SUMMARY AND CONCLUSIONS

This chapter then, has introduced General Systems Theory as an approach to phenomenon investigation, and more specifically, has proposed a GST style approach as the means of exploring the phenomenon and notion of change. The approach has been explained, and can be summarised here as follows:

1. Identification of change phenomena from a range of different disciplines.
2. Analysis of the theories and concepts used by the relevant scientific community to describe them.
3. Compilation of insightful change metaphors and common concepts.
4. Construction of an initial generic change framework based upon (2) and (3).
5. Application of the framework to the target domain - organisations.

Some examples of organisational theorists who have tried cross disciplinary studies were given, demonstrating that such research is possible and has produced some fruitful results already.

It is acknowledged that exploring the concept of change using the GST style approach described in this chapter, may not in the short term yield the comprehensive and robust methodologies which change management practitioners desire. The initial thrust of the approach is certainly abstract and conjectural in nature. However, as Lundberg (1984) observed while discussing the notion of change within organisations,

> "...even speculative reasoning which is carefully done and which probes the pragmatic dimensions of a major, increasingly crucial phenomenon, has utility, for it begins to inform and guide practice and to stimulate inquiry."
>
> (Lundberg, 1984: 61)

Pursuing this GST style approach should open up an abundance of change concepts from across the disciplines, making them available to specialists within organisation theory and the management sciences. It is hoped that in the long run, these will provide organisational change theorists and practitioners with a fresh source of rich concepts, metaphors and analogies from which they can draw inspiration and enhance their language, theories, and methods. The derivation of new and original change metaphors using the approach outlined in this chapter, could do much to revitalise our conception and comprehension of the nature of change within organisations.

CHAPTER 4

MULTIPLE PERSPECTIVES ON CHANGE

A Social, Physical and Natural Science View

"To say with the ancient philosopher 'All is flux' is perhaps too obvious. But to say 'All is change' is far from obvious. There are, on the surface at least, too many clear evidences of fixity and persistence." Nisbet (1970: 177)

4.1 INTRODUCTION

This chapter explores the principal philosophical and conceptual aspects of change. Firstly, an examination is made of the ontological and epistemological issues associated with change. Then a range of definitions and perspectives on the concept of change is explored, from the social, physical and natural sciences. The chapter concludes by drawing out the recurring themes of change and associated measurement issues raised by this review.

4.2 PHILOSOPHICAL ASSUMPTIONS ABOUT THE NATURE OF CHANGE

Burrell and Morgan (1979) have explored some of the fundamental assumptions that underpin theoretical and methodological research in the social sciences. Specifically, they discuss the differing stances adopted by social theorists in the areas of ontology, epistemology, human nature and methodology. Chalmers (1982) has identified a similar set of assumptions for the natural and physical sciences. (See Appendix B for a brief overview and comparison between the two.) Some of the concepts which they examine are a useful starting point for examining the various assumptions upon which our understanding of the notion of change is based. The way in which change is perceived and interpreted as a phenomenon is greatly influenced by these assumptions.

4.2.1 The Ontology of Change

According to the **realist** position (Burrell and Morgan, 1979), change can occur regardless of one's perception of it, and can therefore take place beyond human influence or control. In addition, the realist view assumes that a changing reality exists 'out there' as a seamless dynamically interacting whole, regardless of the labels and vocabulary used to portray it. This means that change descriptions such as evolutionary; radical; second order; incremental etc., are merely descriptive terms employed to try and define specific dominant attributes which are of interest and relevance to the enquirer and his time frame. Whether such terms are accurate and representative, fully capturing the actual dynamics of the change, is inherently difficult to assess. There could well be aspects of the change occurring *beyond* the scope of human perception and measurement of which the observer is completely unaware. Within the natural and physical sciences, Chalmers (1982) describes a similar ontological stance called **objectivism**.

An alternative view of change is offered by the **nominalist** (Burrell and Morgan, 1979) or **individualist** position (Chalmers, 1982). According to this view, change does not occur independently of human cognition. Hence, a changing reality cannot exist outside of the mind as individual perception essentially creates it. Clearly here, concepts and labels are key to expressing and giving actual substance to a particular change being perceived. As a result, a dearth of suitable descriptive language can severely restrict the nominalist's awareness and understanding of change phenomena which he encounters. For the nominalist then, the use of metaphor and analogy represents a useful palette from which to draw images and descriptive labels to explain and communicate change events and processes.

A distinction was made in Chapter 1 between change as a concept and change as a phenomenon. This is essentially an ontological distinction between the phenomenon of change as it 'occurs' and the concepts and theories of change which are used to describe our perception and experience of it.

Another aspect of the ontological debate - whether one holds a realist or nominalist position - concerns the nature of reality itself. Is it considered to be one of perpetual flux and change as Heraclitus believed: "You cannot step into the same river twice; for fresh waters are always flowing in upon you" (Heraclitus, 500 B.C.) ? Alternatively, is reality to be viewed as fixity and permanence of form, as Parmenides (450 B.C.) suggests? In his later life, Einstein took this latter view. He used the analogy of a film to describe what he believed to be the unchanging, predetermined nature of reality: "...in the eyes of God, the film was just there, and the future was there as much as the past: nothing ever happened in this world, and *change was a human illusion*, as was also the difference between the future and the past." (Einstein, 1950: 90 - emphasis added)

4.2.2 Epistemology of Change

According to the **positivist** view (Burrell and Morgan, 1979) or **rationalist** position (Chalmers, 1982) knowledge about change can be acquired in an objective manner. Change phenomena are deemed to be inherently measurable and therefore descriptions and explanations of them can be verified or falsified. A common understanding and view of a particular change activity or process can be obtained and communicated. For the positivist, change is fundamentally an explainable and predictable phenomenon because of the belief that objective measurement is possible, and that a cumulative knowledge base can be constructed to describe it. Cause and effect relationships are believed to be identifiable.

On the other hand, the **anti-positivist** stance described by Burrell and Morgan (**relativist**: Chalmers, 1982) takes a very different position. Here, knowledge and understanding of change phenomena cannot be objectively acquired, only *experienced.* Accordingly, any knowledge derived comes from individual perception and interpretation via direct contact with the change itself. As a result, there is no common knowledge base shared between observers, as all see a given change from differing perspectives. The notion of change here then is subjective, intangible and soft in nature, with consensus and communication inherently difficult to achieve.

There is clearly a link between ontology and epistemology - ie: between the nature of reality, and the way in which we choose to extract knowledge from it. The knowledge derived is capable of changing the way in which we perceive the world and (depending upon one's ontological stance) able to actually change reality itself through application. This in turn will promote changes in how one attempts to gain further knowledge. In this respect, the social sciences are fundamentally different from the natural and physical sciences as Vickers (1983) has convincingly argued.

He uses the following illustration. Copernicus and Ptolemy had very different theories about the structure and workings of the solar system. Whether one believed in one theory or the other did not change the *actual* structure in the slightest. On the other hand, Marx produced a theory of history and social development: belief in that theory by some, has fundamentally changed the course of human history. Clearly, this difference between the physical and social sciences is based upon the degree to which the theorist is part of the system he is attempting to describe, and presents serious philosophical dilemmas for the nominalist.

Exploring the knowledge - reality relationship further, if we take a Heraclitian perspective, the language and knowledge available at time t is only capable of describing a past reality, and how it has evolved up to time t. To understand future change dynamics at $t+1$, the language and knowledge available must evolve to a higher level. In other words, to describe change and the emergent properties it produces, new descriptions must continually be generated. Figure 4.1 illustrates this process. An evolving or changing system therefore requires an evolving language to describe it. Lofgren (1980) has called this 'linguistic complementarity'.

4.2.3 Human Influence and Change

Here we are concerned with issues of individual creativity and human ability to influence the magnitude and direction of change activities within a system. Drawing from the work of Burrell and Morgan (1979), there are broadly two schools of thought. According to **determinist** thinking, human activity systems are dictated by their environment, both in the immediate and long term. Change phenomena in human behaviour is therefore viewed as mechanistic and deterministic in nature, caused and shaped by external forces beyond the control of individuals inside the system. **Voluntarists** offer an alternative view. For them, human systems are viewed as largely autonomous possessing free will. As a result, internal change is within the control and influence of the system. Change behaviour is individually created and spontaneous in origin. Therefore, the potential exists for immense variety and unpredictability. Taking this view allows for the possibility of emergent behaviour and change at the level of the whole which could possibly affect the *external* environment over time.

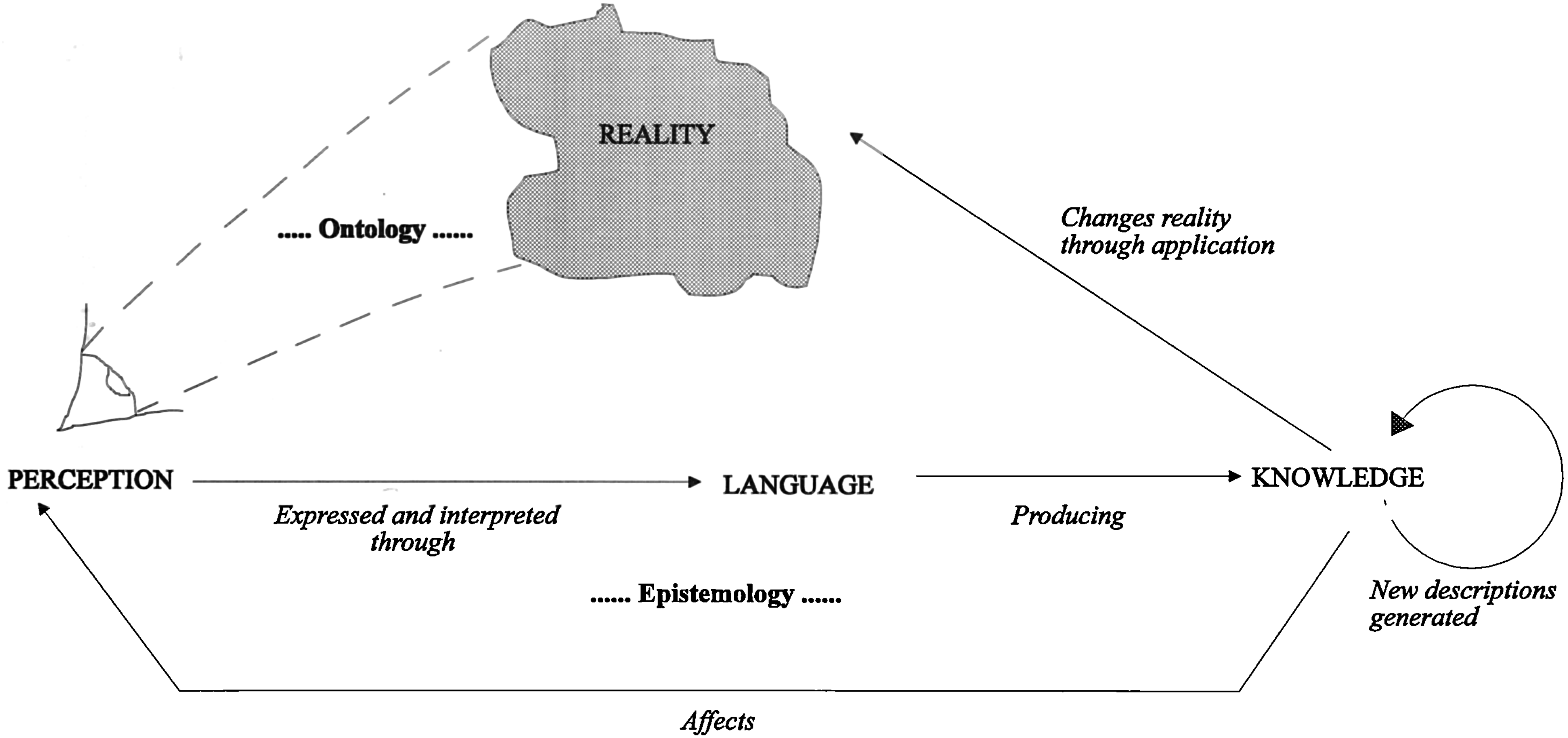


Figure 4.1: Evolving language to describe change

4.2.4 Methodological Intervention and Change

As Chapter 2 highlighted, methodologies for achieving planned change and effective system intervention can take many forms. At a general level, Burrell and Morgan (1979) have identified two underlying philosophical stances with which to describe intervention methodologies in the social sciences. Here they are described in terms of their implications for understanding the nature of change. **Nomothetic** methodologies for effecting change are based on the identification of similarities and patterns within a system. Such approaches embody a belief that an optimal change strategy exists which must be found, and employ rigorous scientific analysis to discover it. The concept of change associated with this positivist style methodological position is one of direct interference with the system, involving analytical disassembly in a hard, reductionist manner. In these terms, the methodologies of Hall (1962) and Jenkins (1969) can be described as nomothetic. On the other hand, an **ideographic** methodological approach places great emphasis on human relationships and softer aspects of change within a system. Pluralist viewpoints abound and the approach towards managing or analysing change is more qualitative. Methodologies of this kind seek to drive change through the exploration and resolution of differences of opinion, paradox, contradiction and ambiguity: see for example Quinn and Cameron (1987).

Another distinction which can be made concerning methodological approaches to planned change, is whether the intervention is systemic *or* reductionist in nature. Systemic change approaches will take into account the interconnected and interdependent nature of systems, and the changes resulting from complex cause-effect feedback loops - both within the system, and across the system boundary with the environment. Broadly speaking, ideographic approaches are more orientated towards such a focus upon *relationships* and emergent change behaviour. Reductionist interventions on the other hand, will by definition, tend to be nomothetic in their examination and management of change. The constituent *elements* of the system under study, and their hierarchical position within the systems structure, tend to be the focus of attention.

This concludes the first part of the chapter. The different philosophical assumptions outlined here provide a context within which the nature of change can be debated and explored. They will be referred to as the rest of the thesis develops. The next section seeks to build upon this conceptual foundation by reviewing a range of definitions for change from across the social and natural sciences.

4.3 EXPLORING DEFINITIONS OF CHANGE

The Oxford English Dictionary defines *change* as "...making or becoming different; difference from previous state; substitution of one for another...". This captures two contrasting attributes. Firstly, that of 'making' or 'becoming' which implies process and activity over time. And secondly, 'substitution' suggesting that change can also be more of an instantaneous event, in which a physical switch over takes place at a discrete moment in time. Dissecting the definition further, 'making' can imply a planned and directed change endeavour, whereas 'becoming' suggests a more natural, unconscious change which is intrinsically part of the life cycle of the entity or system concerned. This basic definition provides an initial working description for change and the themes it contains will be explored as the thesis develops.

4.3.1 A Social Science Perspective

Researchers across the social sciences have grappled with defining the concept of change. Thomas and Bennis (1972) describe it in terms of conflict, revolution, uprising, and rebellion. Deutsch (1966) on the other hand discusses change in terms of feedback through active goal seeking and perpetual learning, while Oliga (1990) argues that change and stability are a function of ideology and power. As Berg (1979) has noted, the problems of definition are due in part to the fact that there are a multitude of concepts that can and have been used to describe change phenomena. The use of different vocabularies and the problem of finding the right descriptive concepts to use which have agreed meanings, further complicates the issue. This problem has its roots in the ontological debate discussed earlier between the realist and nominalist positions. Unable to reach any definite conclusions, Berg arrives at a simple and somewhat thesauratic definition: "Change belongs to a set of concepts (such as development, growth, evolution, transition, renewal, progress, revolution, transcendence, etc.) that are used to describe similar phenomena..." (Berg, 1979: 19).

Coleman (1968) highlights the perception and measurement aspects of change, defining it as a concept which:

> "...is based on a second order abstraction, created through a comparison or difference between sense impressions of two component states, while simultaneously comparing the time positions when those two impressions took place. Thus the concept of change requires an extra intellectual leap beyond the mere formation of concepts that reflect a state of the world. "
>
> (Coleman, 1968: 428)

Here we see the importance of time, as the continuum on which change occurs. Coleman's definition also highlights the role of perception and cognitive processing in identifying change, as well as the position of one observer relative to another. As Einstein (1921; 1952) has clearly demonstrated, simultaneous experience of a given event does not hold true for all observers. Indeed, Einstein's Special Theory of Relativity shows that even the passage of time is relative to individual observers. By necessity, this introduces a subjective and pluralistic aspect to the definition of change. Because of this, Coleman argues that mathematics is the only language which can measure and define the attributes of change, without unduly complicating it.

Building on the work of Dahrendorf (1959ab) and Hernes (1976), Van de Ven (1987: 339) suggests that a good, robust theory of change in social structures should satisfy four basic requirements:

- It should explain how change, behaviour and structure are interconnected at both macro and micro levels of analysis.
- It should describe how change is a function of internal and external factors.
- It should account for both change and stability.
- The theory should incorporate time as the "key historical metric"

The use of time as an historical benchmark in the measurement of change is however, only possible within certain broad limits. For most practical purposes within social research, this is acceptable. However, beyond those limits, relativity begins to influence perception as previously discussed, and time ceases to be a universal positivist absolute to which every change event can be tied.

In describing the history of ideas and events, Foucault (1972) outlines a similar multi-layered, non-linear view of change, with change processes moving at different speeds across different levels of analysis. He argues that our understanding of the nature of change is not sophisticated or subtle enough to identify the slower, silent and deep moving, underlying change processes at work, that "...history has covered with thick layers of events." (1972: 3) with the consequence that events get lumped together and labelled according to the more discernable and obvious changes,

> "....as if time existed only in the vacant moment of the rupture, in that white, paradoxically atemporal crack in which one sudden formulation replaces another." (Foucault, 1972: 166)

This aggregation of events, while maybe serving as a useful approximation, implies that the key dynamics of change can often be missed or ignored. The extent to which this is a failing of the measurement abilities of the observer will be discussed in Chapter 6, but it does suggest that the concepts and empirical approaches for measurement within social systems are not as holistic and sophisticated as they need to be for change management practitioners.

Lauer (1971) argues that research into the nature of change within social systems has been constrained and 'neutralized' by certain misleading common sense assumptions. These he calls *fallacies* and suggests that they have gained such scientific legitimacy as to impede further study into the nature of change:

1. Change represents some deviance from the norm.
2. Change is associated with trauma and crisis, to be regarded as foreign and unwanted.
3. Change is considered to be unidirectional and deterministic, converging inevitably towards some predestined end.
4. The difference between theories of change and theories of stability constitutes a semantic illusion.

Lauer concludes that an understanding of the converse of the above fallacies would serve to inspire further theoretical exploration into the nature of change:

> "Specifically...that change is normal; that change carries with it no intrinsic trauma; that diverse patterns of change and a range of future alternatives are open to any society; and that whether one assumes change or persistence as the basic reality has both theoretical and practical consequences of import."
> (Lauer 1971: 887)

Here again we see the importance of the distinction between the Heraclitian and Parmenidian ontological positions (discussed earlier - section 4.2.1) on the nature of 'basic reality'. Furthermore, it is worth noting that Lauer's proposition that change is not inherently traumatic is somewhat arguable: there is little doubt that the implementation of change within social systems can often be very disturbing for the individuals concerned - whether it need necessarily be that way is the key question. Nevertheless, Lauer's analysis represents a genuine attempt to explore the nature of change in a social context, by examining some of the common misconceptions which often distort our understanding of the concept.

Within the field of theoretical sociology, Nisbet (1970) has defined change as "...a matter of observation; it is something experienced, something that we are justified in referring to as empirical. We become aware of change through our perception of differences in time within a persisting identity." (Nisbet 1970: 177). From this definition, he clearly identifies three key components of change:

- o The passage of time.
- o The maintenance of identity.
- o The perception of differences.

He goes on to argue that mobility, activity or motion do not in and of themselves constitute change, but acknowledges that they are often associated with it. Here we see an attempt to define change by describing what it is *not*, and this is useful in placing broad limits around the concept. However, the idea that change cannot be said to have occurred if there is no continuation of identity, is debateable. Several authors have explored this issue in detail (see Taylor 1921; Moore 1963; Bock 1956). Nisbet's belief that identity must persist for change to occur can be challenged, as it would appear to confine the concept of change to first order, minor variations. It can be argued that in the event of system identity not being maintained, change has still occurred but of a distinctly different type. Major structural change often brings about a shift in identity, but nonetheless still constitutes change.

Discussing social change specifically, Nisbet (1970) makes six assertions:

1. Persistence, stability and inertia are as real as change and movement.
2. Major structural change is usually initiated by some trigger external to the system.
3. Social change does not result from emergent evolution- ie: change from the current state to some future state is not connected by some causal linkage.
4. Social change is not autonomous or automatic. It does not occur by default.
5. Social change and historical events are inseparable over time.
6. No grand theory describing both social change and stability can ever be developed.

Several of these points are debatable. Point 1 suggests a realist ontological position which is both Heraclitian *and* Parmenidian. Nisbet argues that change is fundamentally spontaneous, punctuating social existence sporadically over time (point 3) in a similar manner to that proposed by Gersick (1991) and Miller and Freisen (1980b) - (see section 2.6). However, unlike Foucault discussed earlier, he denies the existence of deep, slow moving incremental change processes within social systems (point 4). And he disagrees with Van de Ven's position examined earlier, by suggesting that change and stability can only be explained by separate theories, and should not be considered together.

Burrell and Morgan (1979) take a similar stance to Nisbet on the issue of change and stability. Building upon the opposing social theories of *order* and *conflict* developed by Dahrendorf (1959b), they propose two philosophical frames of reference: the sociology of radical change, and the sociology of regulation - illustrated in Figure 4.2:

The Sociology of Regulation:- *associated with:*	The Sociology of Radical Change:- *associated with:*
Status quo	Radical change
Consensus	Modes of domination
Solidarity	Emancipation
Actuality	Potentiality
Social order	Structural conflict
Need satisfaction	Deprivation
Social integration & cohesion	Contradiction

Figure 4.2: The sociologies of regulation and radical change as proposed by Burrell and Morgan (1979: 18)

They argue that to conflate the two models of social behaviour ignores the fundamental philosophical differences between them:

> "We conceptualise these two broad sociological perspectives in the form of a polarised dimension, recognising that while variations within the context of each are possible, the perspectives are necessarily separate and distinct from each other" (Burrell and Morgan, 1979: 19)

While such a mutually exclusive distinction is helpful when examining human motivation, decision making regimes and social goal seeking, at another level of analysis, radical change and regulation are merely reciprocal concepts - two sides of the same coin. Over time the equilibrium of regulation may be disturbed, and the social system may move to a sociology of radical change. Granted, the two may never exist together, but a system can exhibit both separately over a period of time. Moreover, examined historically, the phenomenon of 'radical change' in social systems cannot be identified and understood without the occurrence of stability and regulation to compare it with.

Bahm (1979) takes a philosophical view of change, stating simply "A thing may change by gaining a part, by losing a part, or by exchanging parts. A thing can change completely only by ceasing to be." (1979:132). This is in total contrast to Nisbet's definition discussed earlier, where 'ceasing to be' would mean a loss of identity and therefore would not constitute change. Bahm argues that change is interdependent with the concept of permanence, the two notions being complementary and polarly related. He suggests that for change to have occurred, there has to be an element of permanence to it. Otherwise change becomes an instantaneous thing, where any difference or alteration created immediately ceases to exist. On the other hand, impermanence and temporality is required for change to occur in the first place. He goes on to examine change as the product of cause and effect relationships, emphasising that change can be conceptualised as multilevel causality over time.

Widaman (1991) explores various ways of representing and measuring change, making a distinction between qualitative and quantitative changes. The former he defines as "...change in the organized form of behaviour that the subject exhibits." (Widaman, 1991: 205). Quantitative changes on the other hand are viewed more in terms of the analysis of static differences. However, there can be a degree of interdependence between the two definitions, with qualitative changes being expressed in terms of relationships between quantitative changes. Nonetheless, Widaman acknowledges that the distinction between qualitative and quantitative change is not clear, and poses several exploratory questions as to the nature of change: "How are we to conceive of change? What changes? Why does change occur? How does change occur? How much change occurs?" (Widaman, 1991: 205) He concludes that much research into change is reductionist, examining variations in specific parts and relationships of a system and from the results, trying to infer something about the nature of change at the level of the whole.

In an examination of change within human behaviour, Nesselroade (1991) has stated that "...change can (and should) be defined across a complex of observations, the dimensionality and nature of which are carefully chosen to reflect the various phenomena of interest to the investigator." (Nesselroade 1991: 93). In attempting to define change, he makes two interesting distinctions. The first is between change and variability: that is, those changes which are relatively permanent and those which are more short term reversible fluctuations. Nesselroade describes variability as constant background noise or steady state 'hum' which constitutes minor fluctuations around some basic state or condition, but does not constitute change - for example human moods. The second examines slow, more regular change that is typified by learning and development - for example, trait and character change. This notion of background noise change will be returned to in Chapter 6.

Discussing the notion of change from the perspective of the historian, Krieger (1992) defines change in terms of purpose. He denies that there is or ever has been some coherent, progressive purpose to change, defining it as "...a sequence of wayward accidents, each subject only to local forces and not a rationalized, timeless pattern." (Krieger, 1992: 12). In analysing major change throughout history, there are certainly change events which could arguably be described as *purposeless* in the sense that they were not designed or planned with specific goals to be achieved: for example the climatic changes which brought about the ice age, the evolution of language and social behaviour, or the advent of the Great Plague in England (Bell, 1994). On the other hand, the rise and fall of empires or the advancement of technology over the centuries could be classed as *purposeful* - the result of human ambition, intellect and creative ability. This issue of purpose highlights the distinction between planned and designed change on the one hand, and arbitrary, unexpected change on the other - a teleological distinction which will be examined further in Chapter 6.

4.3.2 A Physical Science Perspective

The concept of change within the physical sciences has been significantly influenced by the prevailing scientific world view. The perceptions Newton had of the universe were markedly different to those of Einstein and his contempories in the so called quantum age. As Davies (1980: 21) has noted, "Newton's mechanics is a description of change, the reorganisation of the world according to the passage of time." Quantum theory on the other hand has no room for the notion of universal time, and the concept of change takes on a new identity, becoming inherently indeterministic and associated with uncertainty. Figure 4.3 overleaf highlights the main differences:

NEWTONIAN VIEW OF CHANGE	QUANTUM VIEW OF CHANGE
Change is deterministic and predictable assuming initial conditions are known.	Knowledge of initial conditions is not sufficient to predict change. Quantum laws only permit prediction based on probabilities about possible outcomes.
Chance = ignorance of initial conditions	Chance = genuine unpredictability
Describes reality assuming the observer is independent of the phenomenon being observed and measured.	Describes reality assuming the observer in *not* independent of the phenomenon being measured.
Closed universe	Open universe
Past, present and future are clearly definable in the 'now'.	No concept of universal time - past, present or future.
Change at the macroscopic level governed by Newton's laws.	Change at the macroscopic level approximately concurs with Newton's laws.
No concept of irreversible change.	Irreversible change believed to occur.
Change at the microscopic level assumed to be governed by Newton's laws.	Change at the microscopic level proved not to explained by Newton's laws.

Figure 4.3: Quantum and Newtonian views of change compared

The shift in thinking is quite dramatic. The ontological position swings from being realist to nominalist. With quantum theory comes the realisation that change at a microscopic level cannot be understood, examined or measured 'independently'. As Prigogine has noted:

> "Quantum mechanics is a microscopic theory in the sense that it was introduced with the primary purpose of describing the behaviour of atoms and molecules. Thus, it is surprising that it has lead to the questioning of the relation between the micro world we seek to observe and the macro world to which we ourselves and our measuring devices belong"
>
> (Prigogine 1980: 48)

It is the author's belief that the new way of thinking associated with quantum theory has not yet been fully accepted by the systems and organisation theory communities - particularly with regard to the notion of change. Zohar (1990) has made a useful start in applying basic quantum concepts to social and organisational behaviour, exploring the conceptual implications of quantum indeterminism: "At the level of analogy, quantum physics is rich with imagery that almost begs application to the experiences of daily life." (Zohar, 1990: 4). Wheatley (1992) has also suggested some interesting parallels between quantum mechanics and human behaviour. However, much remains to be done. Certainly, the open system concept has been embraced with its notions of complexity and dynamical behaviour. Nonetheless, the interconnected and problematic issues of measurement, micro-macro levels of description and irreversibility have yet to be given adequate attention. In attempting to understand fully the nature of change, both in natural inanimate systems and human activity systems, these issues have much to offer. Recognising their existence and building them into the fabric of our models of change will make them more representative of the phenomenon they attempt to describe. Some of the change phenomena examined in the next Chapter will explore these ideas further.

Prigogine (1980; 1981) has made a useful start in exploring the nature of change in the physical sciences, particularly physics. He outlines three basic descriptions, or levels of change: macroscopic, stochastic and dynamic change in an attempt to unravel the concept of irreversibility. At the macroscopic level, most interactions are linear; small fluctuations at the micro level average out for large systems, and a normal probability distribution applies. At the stochastic level, interactions tend to be non-linear. Instabilities arise as fluctuations at the micro level and are amplified, leading to multiple bifurcation points within the system. The Central Limit Theorem as it applies to a normal probability distribution breaks down. Finally, at the dynamic level change is described by classical quantum mechanics, with all conceivable states of the system and outcome probabilities being considered within a single defined phase or possibility space.

These three levels offer graduated descriptions of the complexity and nature of change. Accordingly, micro level change can be averaged out and not affect higher levels (macroscopic), or it can be amplified resulting in change at higher, macro levels (stochastic). Prigogine then, places considerable emphasis on different levels of change, particularly the distinction between macro and micro levels.

In his discussion of basic principles of evolutionary dynamics, Jantsch (1980a) also distinguishes between three different types of change:

> **Ontogeny**: "...the evolution of any coherent system through a sequence of space-time structures. The logical process of organisation remains largely the same." For example, the non-sexual reproduction of bacteria through horizontal gene transfer, with no separation of generations.
>
> **Phylogeny**: "...any coherent sequence of ontogenies implying a change in the logical process organisation. There may be repeated branching into a multiplicity of such sequences (cladogenesis)." For example, the growth and expansion of cities over time.
>
> **Anagenesis**: "...the evolution of evolutionary dynamics, bringing into play new levels of evolving systems..." This he describes as *metaevolution*, a kind of recursive dynamics which occurs across different scales of analysis. For example, the transition of sub-atomic particles from independent entities to atomic nuclei, to atoms, and to molecules.

In his discussion of change concepts, Jantsch makes a clear distinction between evolution and growth, the latter being merely a "...multiplication of the same space-time structure..." (Jantsch, 1980a: 86). Here, change as evolution has the potential for core structure alteration, whereas change as growth does not. Elsewhere, Jantsch highlights the multidimensionality of change and states: "Change, increasing in an absolute sense, occurs not only vertically, in a historical time, but also horizontally, in a multitude of simultaneous process..." (Jantsch, 1980b: 256)

As previously mentioned, one of the earliest descriptions of change within physical systems is Newtonian mechanics: the reorganisation of reality according to the flow of time (Davies 1980). Newton's equations of motion represent a model of change for macroscopic bodies:-

- o Change in position relative to some origin point (displacement)
- o Change of displacement (velocity)
- o Change of velocity (acceleration)

Note that each is a subset of, and contains the previous change, in a recursive manner. In mathematical terms, all are vector quantities. That is, the change has two components: magnitude and direction. Although Newton's equations of motion only apply to one dimensional kinematic scenarios - where motion is in a straight line and has uniform acceleration - they do define some basic aspects of change:

- o Change occurs at a certain rate.
- o Change occurs according to the passage of time.
- o Change can have a recursive quality to it.
- o Change can have both a magnitude and a direction.

Prompted by the conceptual advances made by quantum theory, Trifogli (1993) has examined what he calls the *instant* of change: the moment in time when "...two successive temporal parts join..." (Trifogli, 1993: 93). He explores the concept of change within the framework of continuous time, and ponders what constitutes the intrinsic duration of a given change. Is it possible for an entity, in changing from one state (or condition) to another, to simultaneously coexist in both states at the moment of change, or is there some instant during which it is in neither the original state or the destination state? He defines this duration as "...divided into two contiguous motions, and within them both a last instant of the first condition and a first instant of the later are given." (Trifogli, 1993: 107)

Trifogli's work highlights one of the most problematic aspects of change: attempting to determine where the change begins and ends over a given time scale t. While this is partly a philosophical question, it does raise an important measurement issue. The inability to measure at *every value* of t means that determining the instant of the change is inherently difficult within certain systems. To use a photographic metaphor, however advanced a camera is, it is only capable of capturing a finite number of frames per second. There are values of t, and locations on the time-space continuum which exist *between* those frames, and within which change events can take place 'unobserved'. The camera may never lie, but like the human eye, it can also never capture the total stream of events which fall within the view of the lens, because they are taking place outside the time frame of the camera. This is similar to Foucalt's argument that deep, slow moving processes of change within social systems often lie undetected partly as a result of inappropriate measurement tools.

Thom (1975) has explored the paradox of change and stability in nature. He argues that historically, the role of science appears to have been to reconcile this apparent contradiction by removing indeterminism from our understanding of change phenomena. This is partly a perception issue, with stability occurring at one time scale or level of analysis, and change occurring at another. Thom's work highlights this and explores examples of 'change of form' in an attempt to better understand it. Nonetheless, it is possible for change and stability to co-exist on the same scale, and this presents difficulties for planned change management within social systems.

Advances in theoretical physics since Einstein have led Bohm (1957; 1978; 1980) to propose a conceptual scheme which views change and flux as the hidden foundation to the physical reality which we experience. He refers to this as the *implicate order*, and argues that it gives rise to the *explicate order* of perceivable events, objects and processes which we encounter in every day existence. Like Heraclitus, Bohm argues that within the explicate order, stability and 'solidness' are illusions which spring from a quantum world of continual flux, uncertainty and discontinuous change. The sub-atomic particles of which matter is composed are all at various stages of birth and decomposition into yet smaller and more short lived entities, whose fleeting existence give the appearance of stone, water and flesh etc. As Bohm expresses it:

> "The notion of continuity of existence is approximated by that of very rapid recurrence of similar forms, changing in a simple and regular way (rather as a rapidly spinning bicycle wheel gives the impression of a solid disc, rather than a sequence of rotating spokes). Of course, more fundamentally, the particle is only an abstraction that is manifest to our senses. *What is* is always

a totality of ensembles, all present together, in an orderly series of stages of enfoldment and unfoldment, which intermingle and inter-penetrate each other in principle throughout the whole of space." (Bohm, 1980: 183)

Others theorists in the fields of particle and quantum physics - including Nobel Laureate B.D. Josephson (Josephson, 1990; Josephson, Conrad and Home, 1985) - have proposed a similar view of reality, arguing that change is not a phenomenon of the world in which we live, but rather gives form, shape and substance to it (see Leggett, 1986; Capra 1975; Stapp, 1982 and 1985; Villars, 1983). According to this view, researchers should be seeking to identify and understand the underlying dynamics of flux and change upon which physical reality is based.

4.4 SUMMARY AND CONCLUSIONS

This chapter has explored some of the philosophical debates and stances concerning change, providing a context within which to explore further the nature of change in the rest of this thesis. It has also reviewed briefly some of diverse view points and definitions for change which have emerged within the social and physical sciences. The recurring themes from this review regarding the study and nature of change, can be summarised as follows:

1. The role and position of the observer relative to the change phenomenon.
2. The multi-level nature of change and interconnected levels of analysis.
3. Historical time as the continuum upon which change may or may not be said to occur.
4. The dialectic of change and stability.
5. The teleology of change.
6. The (in)deterministic qualities of change.
7. The 'degree' and extent of a given change, and how this is described or labelled.

Associated with these themes, a number of *measurement* issues can be drawn out from the chapter. They focus upon distinctions which measurement approaches and interventionist methodologies should be capable of making and differentiating between, when dealing with change phenomena:

- Mere motion, activity and movement **and** actual structural, behavioural or process change.
- The start of a given change **and** the end of that change.
- The *reality* of underlying flux and dynamics within a system **and** the *illusion* of apparent stability and solidity that it can create at other levels.
- The background noise of reversible, impermanent, reversible changes **and** the slow, irreversible, deep moving changes which are more permanent.

Against the backdrop of the somewhat philosophical examination of change made in this chapter, the next chapter explores specific change phenomena. Many of the themes and issues raised here will be seen at work within the natural and physical science phenomena investigated.

CHAPTER 5

THE APPROACH TRIED

Change Phenomena from the Natural and Physical Sciences

> *"That physical, biological, and cultural changes occur is well known. But how change is conceived is not so well known."*
> (Bahm 1979: 131)

> *"Consequential relations of nature are infinite in variety and he who is acquainted with the largest number has the broadest basis for the analogic suggestion of hypotheses."*
> (G.K. Gilbert, 1896: 1)

5.1 INTRODUCTION

This chapter explores a range of change phenomena from across the physical and natural sciences in an attempt to uncover common themes, recurrent images and unifying ideas regarding the general nature of change. The material is presented in three sections: physics, chemistry and biology, and these are used as broad categories for analysis. Each change phenomenon will begin with a brief technical summary followed by a discussion of any ideas it may offer for abstraction at a general system level. Where appropriate, specific organisational examples are given, although it must be stressed that these are for illustration purposes only. The formal application of the research to an organisational setting will take place in Chapters 7 and 8. This chapter concludes with a summary of the emerging themes and ideas about change, which will be taken forward as a basis for constructing the general change framework (described in Chapter 6).

5.2 PHYSICAL CHANGE PHENOMENA

5.2.1 Introduction

Fundamentally, physics attempts to understand the interactions between energy and matter, and how matter can be changed from one form to another. Here, several physical change phenomena are discussed, along with their scientific explanations, in an attempt to explore this relationship and gain a deeper insight into the dynamics of change.

5.2.2 Phase Transition Theory

This is an area of condensed-matter physics which has been under intensive investigation in recent years. In its broadest sense, a phase transition can be described as the process of transformation from one state of matter or 'phase' to another, typically where there is a distinct qualitative difference between the two phases (Bruce and Cowley, 1981). It is an area rich with theories and concepts attempting to describe the dynamics of the change process occurring during a phase transition.

First order phase transition. These are typically transitions between two phases which are both ordered, but in distinctly different ways. The transition from one type of ordering to the other tends to be discontinuous. Characteristic first order transitions usually start from some metastable state: ie the substance remains in a locally stable state beyond the point when the next phase transition should have started.

Examples include super cooling: water droplets can remain naturally unfrozen in the atmosphere at temperatures far below 0° C, until disturbed. Likewise, the temperature of a vapour can be lowered well beyond the point where condensation into a liquid should occur. Similarly under the right conditions, a liquid can be super heated beyond its boiling point without undergoing a phase transition to a vapour (Waldram, 1985). Such metastable states are highly sensitive to external random noise and contamination, which in the right quantities can cause the metastability to break down, triggering the normal phase transition. Predicting when or how the phase transition will occur is acutely difficult. However, what is clear is that the external noise must be of sufficient magnitude if it is to 'knock' the system out of its local metastable equilibrium and into a more thermodynamically stable state. For the transition to take place, the system must move through temporary states of higher free energy than the metastable state. It must overcome what is known as a 'free energy barrier'. If the free energy barrier is too high, the probability of the transition occurring will be low.

Second order phase transition. As opposed to first order, second order transitions generally occur between disordered and ordered states, in a smooth, continuous way.

For example, the transition between paramagnetism and ferromagnetism occurs at the critical Curie temperature. Heat a ferromagnet up and as it nears the Curie temperature, the normal internal interactions which cause the magnetic dipoles to line up in parallel begin to break down. As a result, the degree of spontaneous magnetism gradually moves smoothly and continuously to zero.

As with first order transitions, the forces and interactions occurring at an atomic level have a significant role to play in affecting the actual temperature and magnitude of the final transition. However, it is macroscopic factors such as what kinds of symmetry and dimensionality define the ordered phase, that determine the critical *behaviour* close to the transition temperature. The extent to which very large collections of particles interact and influence each other increases significantly as the critical temperature is reached.

Many conceptually useful ideas can be abstracted from this area of physics for exploring the nature of organisational change. The notion of metastability is particularly relevant and has been reviewed in detail by Jantsch (1980b: 95) at a conceptual level - particularly the interaction between microscopic and macroscopic factors in determining the nature and duration of a metastable state. It may explain why many organisational change measures do not achieve their objective following implementation. Introducing changes which set some part of the organisation at an 'artificial' level are doomed to failure in the long run, unless considerable resources are expended to maintain it there. Once the implementation team leave and the realities of day to day business reassert themselves, the new procedures and methods of working can seem untenable, causing behaviour to 'deteriorate' back to the old regime. This reversion can happen either suddenly, following some triggering event (first order) or gradually over time (second order). Designing effective changes which will survive, and achieve their objectives, requires careful consideration and analysis of the environment in which they will operate. This is an area much neglected by organisational change practitioners, who can sometimes be too results orientated without considering the long term resilience and viability of the changes they implement.

Many other interesting aspects of change can be drawn from phase transition theory, which may be applicable to organisations. Future research could explore the following parallels:

- Does either the original state or proposed destination state of the organisation possess some kind of structural order?
- If so, how will that order or lack of it, affect organisational behaviour during the transition, and the magnitude and direction of the change?
- What attributes of the organisation are likely to be key determinants of the eventual change?
- At what level of resolution are those attributes: - the level of the macroscopic whole or individual elements?
- Are they structural or process type attributes?
- What 'free energy barriers' must the organisation overcome if it is to move from metastability to some other state?
- What external force(s) acting on the organisation will cause it to change state into and out of metastability ?
- What are the critical values of those external forces, necessary to bring about the change? Are they fixed, or dependent upon the sensitivity of the organisation to disturbance?

Answering questions such as these could lead to a deeper understanding of the nature of the change itself: what critical internal and/or external factors initiate it; what direction it will take; and what internal processes and attributes characterise it - at both macro and micro levels of analysis.

5.2.3 Isothermal Change

This refers to the ability of a substance to be subject to some kind of change but to remain at a constant temperature, usually during phase transition. A good example of an isothermal change process is demonstrated by the concept of latent heat. As defined by Williams, Metcalfe, Trinklein and Lefler (1968), this is the heat absorbed or evolved during a change of state or simply the heat required to cause a change of state. Continued heating of a substance close to phase transition will produce little or no change in temperature - see Figure 5.1. Then at some critical point, the

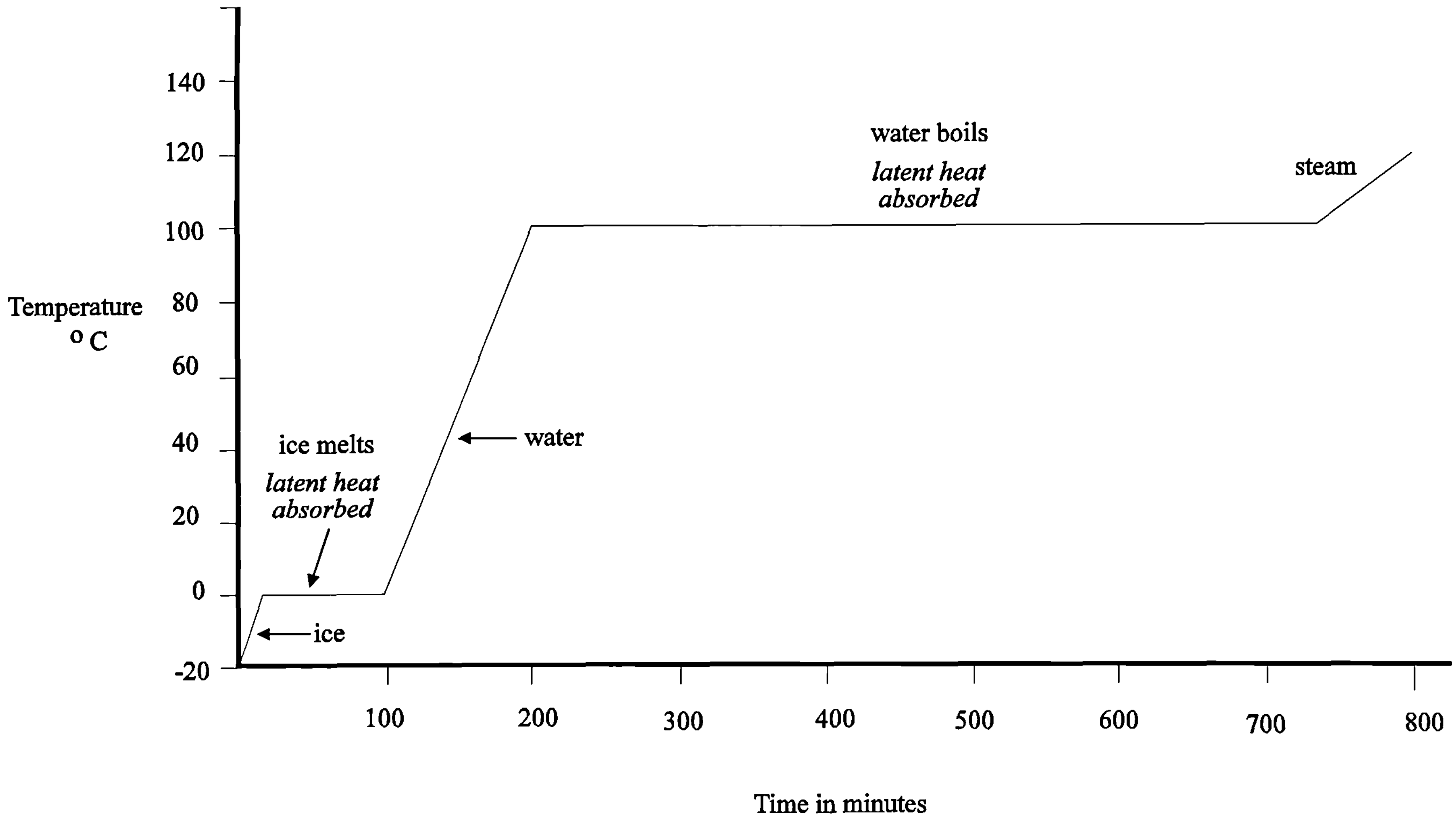


Figure 5.1: Temperature plotted against time, starting with with a 100g of ice at -20 ^{o}C, being heated at a constant 100 cal per minute.

temperature will begin to rise and the effects of the phase transition become more discernible.

Latent heat reveals an important principle of change. In applying some environmental input designed to cause an internal change, the ability of a system to absorb that input without undergoing the desired change must be considered. Before attempting to manipulate or change some attribute, element or relationship the 'latent heat capacity' of the system needs to be assessed, and an understanding gained of the way in which energy is absorbed or reflected. This information would enable a more accurate estimation of how much of the input to prescribe, at approximately what critical point the desired change will take place, and what direction and magnitude the eventual change will possess.

Latent heat and the concept of isothermal change suggest metaphorically that certain situations, processes or structures have the ability to absorb energy up to a point, before undergoing change. As with physical phase transitions, the direction and magnitude of the eventual change may be undesirable, and the timing unpredictable. During system intervention, this metaphor could help practitioners in their thinking about those components of the system which are likely to resist change, and assessment of how resources can best be expended in order to overcome that resistance effectively. A distinction is made here between resistance to change due to absorption capacity, and resistance due to *inertia*. The latter is a direct function of mass, whereas the former is a direct function of a system's ability to absorb energy.

5.2.4 Self-Organised Criticality

The study of complex physical systems with many interacting elements, and their behaviour and evolution over time has been the focus of much attention in recent years (see Jen, 1990; Stein 1989; and Waldrop, 1992). In particular, theories are currently being developed to describe cascading change, and the intricacies of the change process during the two way transition between ordered and chaotic states. The work of Bak, Chen and Wiesenfeld (1988) on self-organised criticality is of particular interest. Simply put, the theory proposes that "...many composite systems naturally evolve to a critical state in which a minor event starts a chain reaction that can affect any number of elements in the system." Bak and Chen (1991: 26).

As a description of change this theory is of special interest because it challenges the notion that a large, complex system undergoes change usually when an environmental influence dislodges it from some internally maintained equilibrium. Rather it suggests that such systems only exist in metastable states, in perpetual 'criticality', where small perturbations can give rise to both large and small system changes. The theory also presents the paradox of dynamic continual change at the micro level coexisting with stability and continuity at the level of the whole. Obviously these descriptions of change are not applicable to all types of system, but as Bak and his colleagues themselves indicate, they may well lead to important discoveries about the nature of change in many fields concerned with large composite systems, including economics, biology, ecology and geology.

5.2.5 Adiabatic Change

This concept describes a thermal change process that takes place in a substance, without the addition or removal of heat from its environment. An example of an adiabatic process is the temperature change of air sealed in a compression cylinder. The alternating compression and rarefaction of the trapped air occurs so fast that it is unable to conduct the local heatings and coolings away from the locations at which they are generated. As a result, the temperature change created in a stratum of air becomes locked in. Boyle's Law is unable to assert itself and the normal internal heat transfer process by convection does not have time get established before the next volume change (Railston 1953).

This change process parallels situations where a system is being subjected to some environmental influence which is changing in magnitude very rapidly. As a result, the normal internal mechanisms and processes for coping with and responding to it are not able to function adequately - if at all. Standard operating procedures are not effective and localised 'overheating' may occur, potentially causing long term damage to the structure of the system.

For example, an organisation may experience a dramatic and unexpected rise in demand for its product. In the normal course of events, gradually rising demand could be matched by the introduction of extra production capacity to meet it. However, in the face of a sudden, enormous increase in demand, the firm cannot resort to 'standard procedure' and the work force may be put under extreme pressure to increase output with existing resources. The stresses created throughout the organisation in attempting to deal with this external contingency may result in unforeseen internal changes. The culture may change as employees become dissatisfied with unacceptable working hours, intolerant management eager to maximise revenue, and a pressurised working environment. Internal processes and procedures may change, as it becomes clear that they are not capable of dealing with the demand. Shortcuts and 'work arounds' are developed and institutionalised. Minor day to day operational problems are left unresolved, and the organisation slips unaware into the early stages of entropic decline.

5.2.6 Evaporation and Sublimation

Evaporation and sublimation are two basic change phenomena that occur at a micro level during a first order phase transition. Evaporation describes the transition from liquid to vapour, and sublimation, the transition from solid to vapour. Both are explained as follows:

> "When a particle on the surface of a liquid or solid acquires enough energy to overcome the forces that hold it as part of the substance, it escapes and becomes a particle in vapour state."
>
> (Williams et al, 1968: 169)

Careful reading of the above statement reveals a wealth of structural analogy about the process of change, applicable at a systems level. Note the following observations:

- The particle has to be on the surface. That is, on or at the boundary with the environment.

  Parallel Example: a clear, unimpeded route to the destination state is essential if change is to be achieved efficiently and effectively.
- The particle must acquire enough energy. This it can obtain from its

neighbours and/or the environment.

Parallel Example: new information, investment capital, personnel, technology are key 'energy' providers to enable an organisation to implement effective change and achieve some significant competitive advantage.

- o The energy must be sufficient to overcome the forces that hold it.

  Parallel Example: building size, internal inefficiency, lack of training or knowledge about the environment can prevent a system from changing. These constraints to change must be identified and overcome.

- o The particle escapes and enters the vapour state. In a literal sense, the particle itself has not changed at all. It has merely achieved access to a freer, less restrictive environment.

  Parallel Example: In the same way, structurally, a system need not undergo internal change at all. Mere exposure to and eventual entry into a higher energy, more dynamic environment can open up new and exciting possibilities for movement. But certain constraints to change must be overcome to achieve this new state.

The metaphor can be carried further on this last point. Immediately following a move into a new environment, a system is exposed to a different set of threats and opportunities. In the case of the vapour particle, it may well come into contact with a cold surface, and be forced to condense back into its original state, with subsequent loss of energy and freedom. Likewise the system may initially start forging ahead taking advantage of all the new opportunities it encounters. However, unless the resources and energy are there to sustain it, it too may well encounter an insurmountable problem, or discover it is not suitably prepared for the new field of operation. Reversion back to its old domain and sphere of influence, with the inevitable loss of competitive edge, may be the only course of action.

5.2.7 Attractors and Repellors within Dynamical Systems

The field of Dynamical Systems Theory (DST) is concerned with defining mathematically the rules which govern the dynamics of a system over time: "...it is the task of mathematical dynamical systems theory to investigate the patterns of how states change in the long run" (Hirsch, 1984). DST is concerned with both discrete and continuous dynamical systems as the work of Aulin (1987), Guckenheimer and Holmes (1983), Aracil (1986) and Smale (1967) demonstrates. One of the fundamental concepts within DST is the notion that systems have *attractors* - that is, one or more states to which the behaviour and trajectory of a system will be drawn and ultimately settle in. These are referred to as structurally stable attractors, if they are identifiable even in the presence of external perturbations and internal noise. Associated with attractors is the concept of initial conditions. If an attractor is active within a system, it will pull the systems initial conditions towards it over time. As Swenson (1989) has noted, an attractor can be defined as:

> "...the time-independent (time-asymptotic) states, or limit sets, that attract initial conditions from regions around them - 'basins of attraction' - during a time dependent process (evolutionary behaviour) as *t* tends toward infinity. All real world macroscopic change is irreversible and hence governed by attractors, viz., the instability of entropy producing processes. ...In this sense, all macroscopic change is *(i)* progressive (goes irreversibly towards an attractor), and *(ii)* goal driven (the attractor is the goal). The attractor drives the evolutionary behaviour by virtue of the instability of all states within the basin of attraction but off the attractor." (Swenson, 1989: 189)

More rigorous mathematical definitions of attractors are discussed in the literature (see Thom, 1975; Zeeman, 1986; Milnor, 1985) but the above is sufficient for the purposes of discussion here. As Swenson suggests in the above quote, the ultimate attractor for all physical systems is thermodynamic equilibrium, where entropy is maximised and the system's identity disappears due to lack of functional structure. However, by far the more frequently occurring over shorter time scales are *emergent attractors*. These are attractors which govern emergent properties and behaviour of a system at the level of the whole, usually through some process of self-organisation.

The DST literature generally discusses three basic types of emergent attractor and these will now be described briefly. The first is a simple point attractor which draws the system towards a stable state. For example: a marble in a bowl, whose motion will be drawn to and eventually come to rest at the bottom of the bowl; or homeostatic behaviour in biological systems. Other more complex point attractors have been discussed by Nicolis and Prigogine (1989) and Hanken (1983). Secondly, there is the limit cycle, closed curve or periodic attractor in which there are usually two points of attraction and the behaviour of the system oscillates between them. These have been identified within systems from a range of disciplines including economics (Sterman, 1988), chemistry (Tomita, 1986) and ecology (Toro and Aracil, 1988). The third type is known as a fractal, strange or chaotic attractor in which system behaviour appears to be completely random over time. Such systems are very sensitive to changes in initial starting conditions, and minor external or internal disturbances to those conditions in two identical systems can result in very divergent and complex behaviour. However, despite the apparent randomness, chaotic attractors identified to date which cause such non-deterministic behaviour, are in fact stable structures which are highly ordered. Popular examples of fractal geometry demonstrate this - self similar recurring structures in nature like fern leaves, clouds and crystals (see Mandelbrot, 1977; Peitgen and Richter, 1986; Garcia, 1991). Gao (1992) has described yet further types of attractor, but in the main these are hybrids of the point, periodic and chaotic attractors outlined above.

In addition, most dynamical systems can possess more than one type of attractor simultaneously. Zeeman (1988) has demonstrated the existence of *repellors*. That is, unstable states which by definition can never be achieved, as microscopic fluctuations prevent behaviour moving in that direction, driving the system towards an attractor. Conceptually, a repellor can be likened to the apex ridge on top of a roof which slopes off on both sides. Anything falling on the roof will immediately be 'repelled' down one side or the other. According to Zeeman, point and periodic repellors have been shown to exist, but so far no chaotic repellors have been identified.

With respect to understanding the phenomenon of change then, attractors and repellors are capable of acting as engines, constantly pulling and pushing a system into different states and modes of behaviour. Drawing on the empirical work of Pascale (1991) and Miller (1990), Stacey (1993) has discussed the possible implications of point attractors towards stability and instability, for commercial organisations operating in a competitive environment. He argues that for an organisation to be successful in the long term, it must maintain a creative tension between these two point attractors, and exist within the border region that separates them - a region of *bounded instability*. Figure 5.2 illustrates these three positions and their

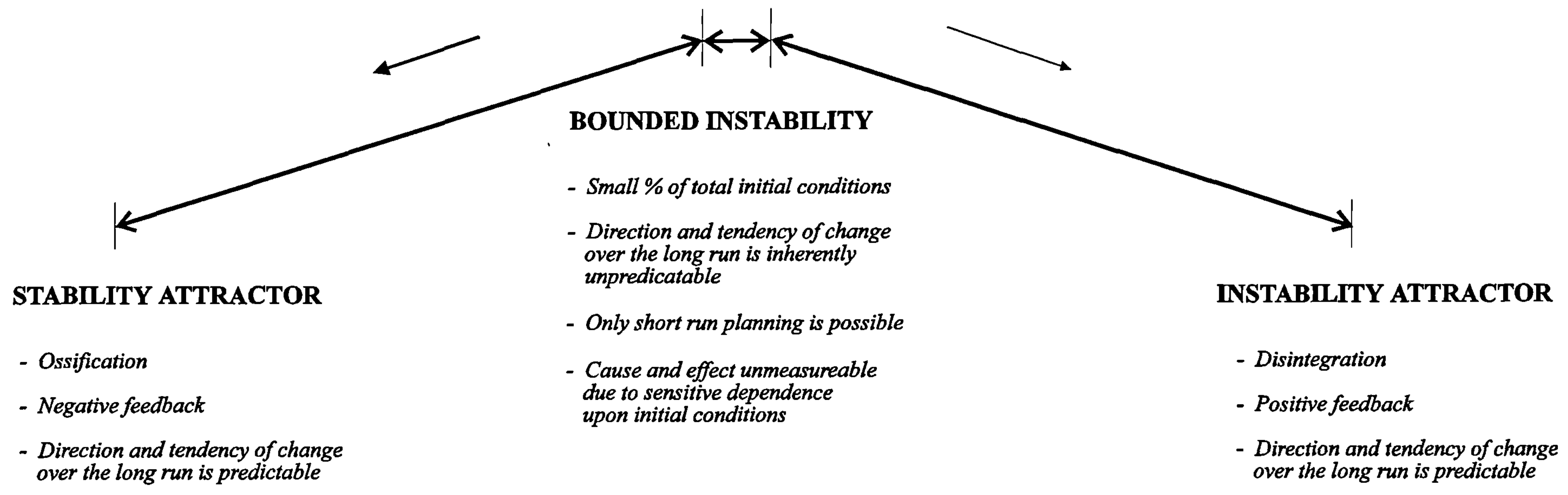


Figure 5.2: Attractors of stability and instability between a region of bounded instability (based on the work of Stacey, 1992; 1993)

characteristics. Stacey does not specifically discuss periodic attractors within an organisational context, but nonetheless his work demonstrates how concepts can be abstracted from the natural and physical sciences, and their applicability explored within an organisational setting.

Wheatley (1992) has also examined the notion of attractor within an organisational context. She proposes the concept of *meaning* as a possible attractor - some corporate vision or statement which provides a coherent purpose and reference point capable of guiding and influencing individual action:

> "When a meaning attractor is in place in an organisation, employees can be trusted to move freely, drawn in many directions by their energy and creativity. ...We know they will all be affected and shaped by the attractor, their behaviour never going out of bounds. We trust they will heed the call of the attractor and stay within its basin."
>
> (Wheatley, 1992: 136)

Wheatley's 'meaning attractor' can be interpreted as a means of constraining change, restricting it within certain limits. She draws parallels between fractal structures in nature, and self similarity and consistency in human and organisational behaviour. Despite the unpredictable and chaotic appearance of many organisational settings, she argues there are patterns, common behaviour traits and recursive structures present which limit and shape macro level behaviour.

The concept of a repellor may be a useful notion through which to analyse behavioural taboos within organisations, such as completing the financial year significantly under budget, or freely relinquishing resources to other parts of the business. In organisations with a strong culture of blame attachment and penalty enforcement for mistakes, a repellor behaviour could constitute 'accepting problem ownership', 'taking the initiative' or 'demonstrating innovative and creative conduct'.

Other theorists have begun to investigate the implications of DST for understanding change within social systems and organisations - see for example Kiel and Elliot (1995) and Gaustello (1995). However, this is a relatively new line of research and much still remains to be done, particularly in establishing the full significance and potential of attractors and repellors for human activity systems.

5.2.8 Nuclear Fission

The process of initiating, sustaining and controlling a nuclear chain reaction has to represent one of the ultimate examples of change management. Harnessing the power of nuclear fuel requires the initiation of a chain reaction within the critical mass of uranium nuclei (for example). In addition to the desired energy released, the fission process produces fast neutrons as by-products of the reaction. In a nuclear reactor these are slowed down by a graphite lattice framework, so they can be absorbed by other fissionable nuclei. In addition, rods of neutron absorbing boron steel can be lowered into the whole structure to moderate further the reaction and control the amount of fast neutrons. Without this essential moderation, the reaction would soon run out of control with devastating consequences. See Figure 5.3.

The above describes a classic example of a change process under very strict control, achieving a desired outcome. Several general principles of change are obvious here. Firstly, to initiate change, some 'critical mass' is required. There must be some basic level of interaction between elements. These could be exchanges with the environment or internal maintenance type relationships. Some input, relationship, emergent property or element must be present in sufficient quantity or strength to enable the change process to start. Within an organisation this could equate for example, to a common vision of the future; level of staff training; motivation; or quality of product.

Secondly, the by-products of the change process must be identified beforehand. Some may be beneficial, some of no consequence, others undesirable. An assessment of these and their potential impact on the system would seem sensible before commencing with a change action. Particularly important is a mechanism that offsets the negative side effects, or better still, turns them to some benefit, as the change proceeds. Thirdly, the development of some means to control *and sustain* the change process once it has been initiated is clearly essential. Too often, insufficient thought is given to this aspect of change during system intervention, resulting in implemented change measures that fizzle out or spiral out of control causing immense damage to

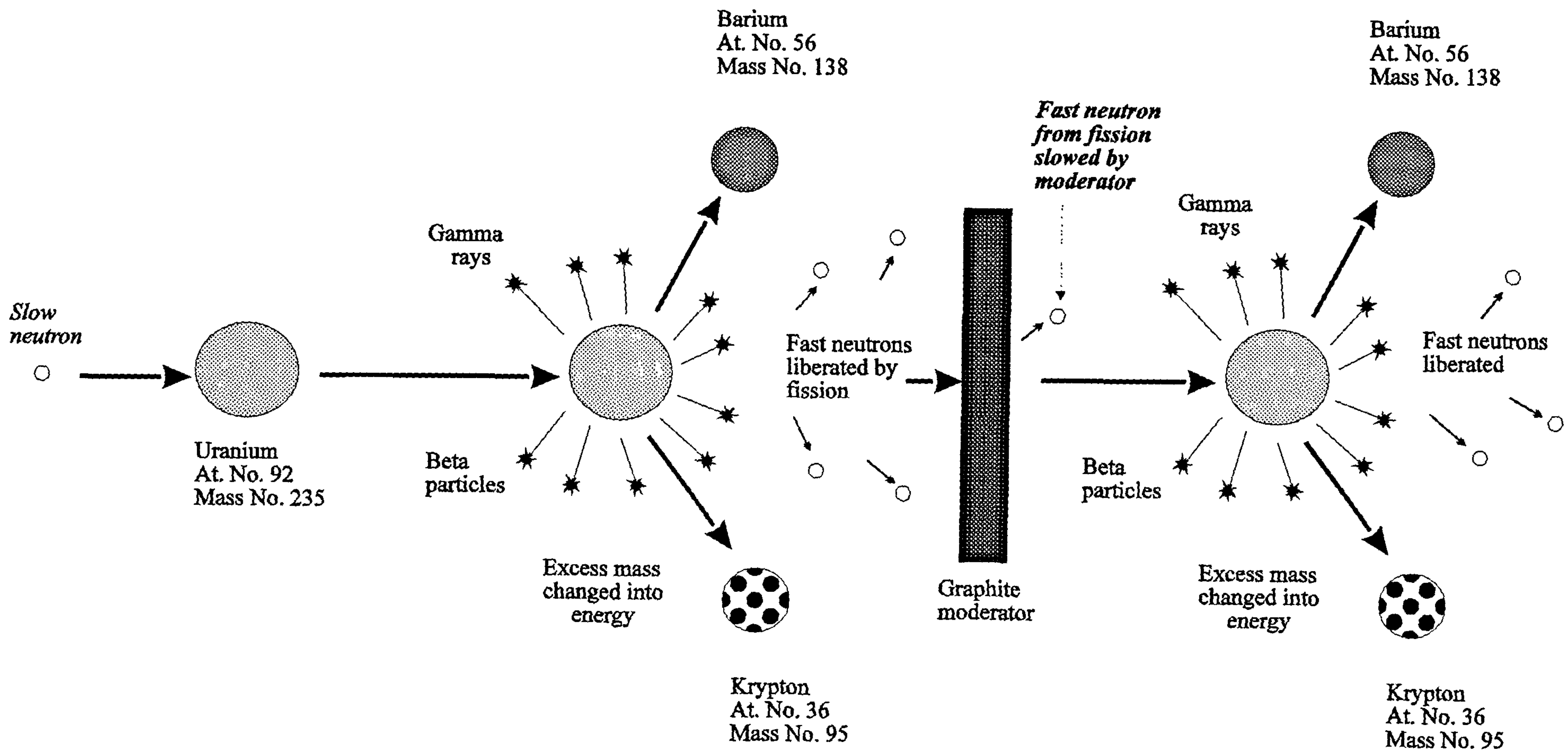


Figure 5.3: Chain reaction resulting from fissionable U-235 nuclei, with moderated neutrons.

the system as a whole and sometimes its environment.

5.2.9 Kinetic Energy

Simply put, this concept refers to the energy a body acquires due to its motion through space and time. A boulder falling from a cliff acquires increasing kinetic energy as it falls, reaching a maximum just prior to impact. At an atomic or molecular level this notion is expressed as the Kinetic Theory of Matter, and explains the apparent random motion of particles in a vacuum, commonly known as Brownian motion.

It can be argued that dynamic systems possess energy resulting from their own internal processes, quite apart from any external inputs from the environment. This energy could be defined as an emergent property arising from the complex interactions and strong relationships between the elements of the system. In attempting to manage or predict change within such systems, some attempt must be made to assess the nature and extent of this energy. Planned system intervention could well turn such internal forces to good advantage, aiding both the efficiency and effectiveness of change initiation, management and final implementation. On the other hand, under-estimating the kinetic energy that will develop in the system once change has been started, could well cause the change measure to accelerate away, out of control - with disastrous consequences.

Viewed another way, attempts to introduce changes which work against the systems internal forces or inherent 'kinetic energy' may well undermine the viability of the whole. Biological life itself is largely the result of complex bio-chemical forces and interactions taking place within an organism at a micro level. Disturbance of these can often be pathological. On the other hand, attempts to counter and overcome them in some systems may well be justified. Successfully introducing changes which achieve this will mean gaining beforehand, a clear understanding of what kinetic energy barriers need to be overcome, and the effort required to do so.

Another useful concept suggested by the concept of kinetic energy is relative motion. The falling boulder possesses kinetic energy relative to the ground. If the ground were moving away from the boulder, the final impact and conversion of energy would be less. Viewed in a systems context, this has a significant parallel. As has been suggested, making some assessment of a system's internal energy prior to introducing a change is important. Therefore, this will necessarily involve taking into account the relative motions or tendencies of different parts of the system *with respect to each other*, before initiating change. Traditionally, something akin to Impact Analysis is often undertaken to assess how and to what extent a particular change measure will affect the rest of the system. The phenomenon of Brownian Motion and the concept of kinetic energy suggests that the relative impact and activity of individual elements relative to one another needs to be considered also.

5.2.10 Potential Energy

This concept can generally be defined as the energy of charge in an electrical field, or the energy of mass in a gravitational field. Both definitions convey the idea of energy possessed by virtue of position. The former referring to an electrical charge or voltage. The latter is associated with the distance a body could move through space and time under the acceleration due to gravity.

To the physicist this would appear to be only a notional concept of energy. The boulder at the cliff top has a definable quantity of potential energy by virtue of its position. However, as soon as it begins to fall its potential energy decreases, tending to zero as it nears the ground. Strictly speaking, it is converted into kinetic energy as Figure 5.4 illustrates.

Potential energy then, implies some tendency towards another position or state, with some associated energy loss. In terms of planned system change, just like kinetic energy, it can be argued that the potential energy contained in a particular system state or mode of behaviour, needs to be assessed prior to intervention. Similarly, before attempting to predict the nature and outcome of an unplanned change within a system, gaining an understanding of what forces lie latent in the prevailing system configuration is essential. Failure to do this could result in those forces being unleashed when the change action is started - like the boulder falling from the cliff top - as the potential energy is converted into kinetic energy. The end net result could

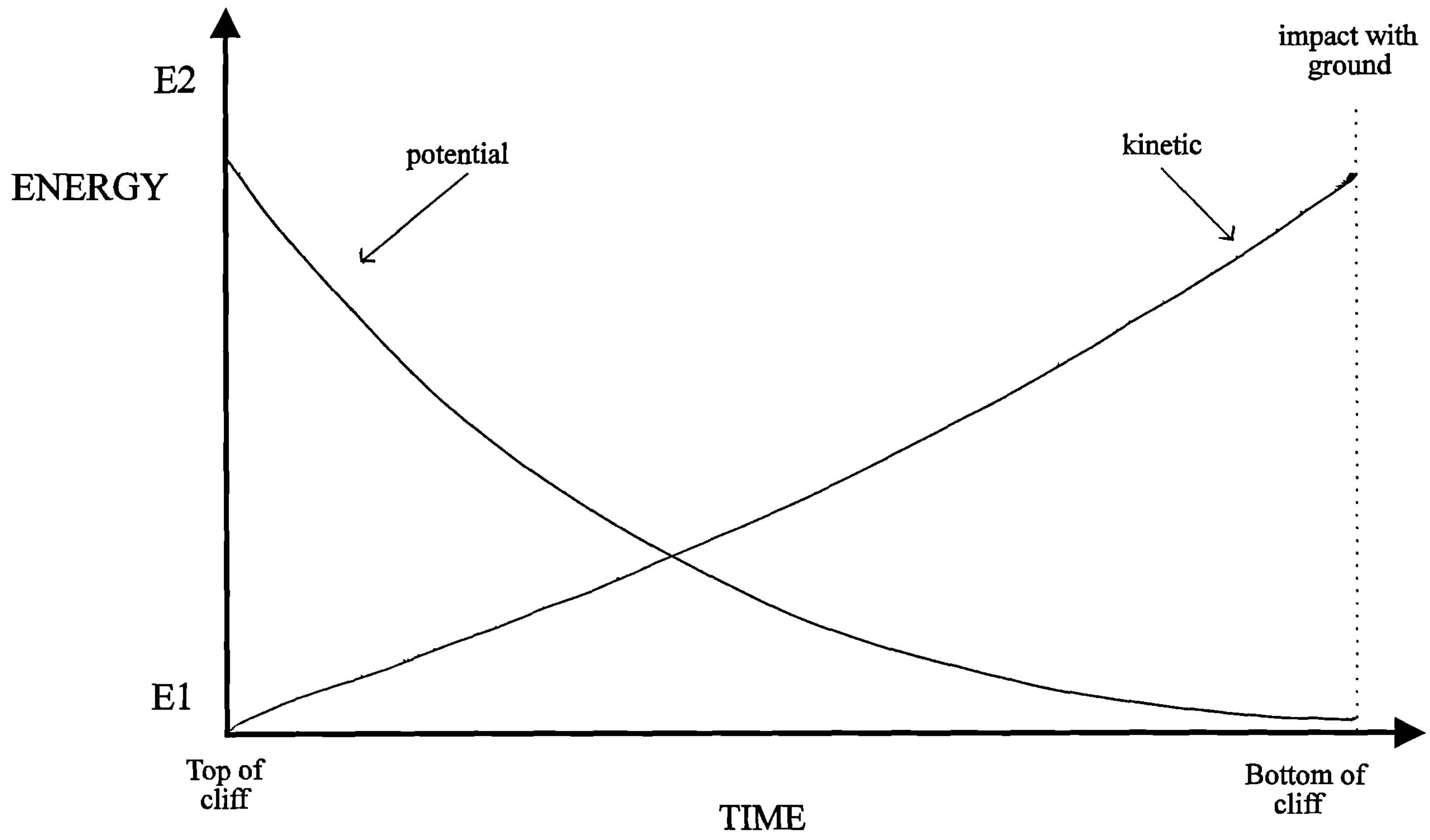


Figure 5.4: Energy associated with change in relative motion and position

be to inhibit the change measure being implemented or at worst cause significant damage to other elements and relationships within the system.

5.2.11 Atmospheric Motion

From large bodies of air and cloud systems to minute particles and molecules of water, the atmosphere is in a state of constant activity and turbulence. The standard atmosphere is generally thought to consist of four layers: the troposphere, stratosphere, mesosphere and thermosphere. Each sits at a certain average height above sea level, and has its own particular composition of gases, average air pressure and temperature. However, the different general characteristics of the various layers mean that this 'standard atmosphere' is rarely stable. Interactions between layers and local differences ensure a continually fluctuating and restless system, producing perpetual movement and dynamic behaviour. Turbulence and air flows at each level interact to produce both global and local changes in weather and climate (Hanwell, 1980; Battan, 1984).

In addition to the dynamics within the atmosphere itself, the complexity of the change processes at work is increased when one considers the interactions between the atmosphere and terrestrial ecosystems such as tropical rain forests, deserts and mountainous regions. These interactions include water, radiation, carbon dioxide, heat transfers as Figure 5.5 illustrates. Ecosystem dynamics are the product of a large number of individual interactions resulting in complex behaviour, involving stability and change at both micro and macro levels.

There are several emerging themes from the area of atmospherics and climatology which are useful for conceptualising change. For example, they demonstrate that change can occur across a range of scales and levels, in a complex and interdependent layering of events. Within organisations different local conditions, such as training levels, resource allocations or work load between different parts of an organisation, can create tension and conflict at the micro level, perhaps leading to a change in culture, productivity or flexibility at the macro level. On the other hand, other macro parameters like levels of investment, corporate image, or organisation size may remain unaffected and stable. Local imbalances can often form the basis for change *and*

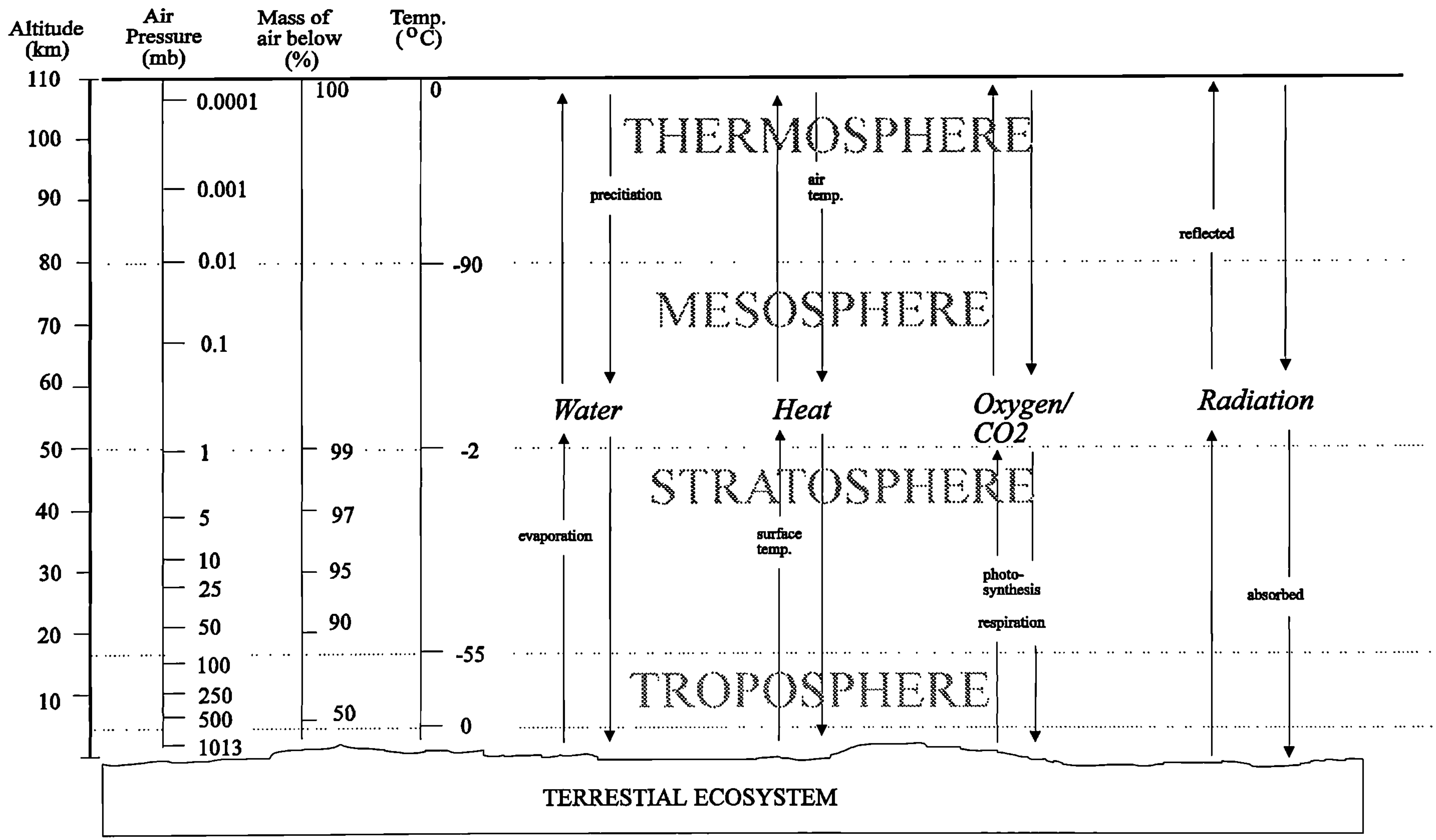


Figure 5.5: Structure and dynamics of the atmosphere (adapted from Hanwell, 1980 and Scholes, 1990)

stability within a system, but at different levels.

In a study of atmospheric and climate dynamics, Scholes (1990) proposes a number of general change principles which can be usefully abstracted for the analysis of system change generally:

- "Multiple, locally stable states separated by transition thresholds are much more likely than global stability;
- Directional change is therefore more likely to be jumpy than smooth;...
- Stability is more likely to be encountered at large spatial scales and small, very short or very long rather than intermediate time scales, and at high integrative levels rather than low;
- Environmental predictability is more important than the absolute magnitude of environmental extremes ('harshness') in determining stability and resilience;..." (Scholes, 1990: 352)

These ideas have tremendous metaphoric potential for exploring the nature of organisational change. There is an emerging realisation in science that it is possible for equilibrium and disequilibrium to coexist at different scales; that change and stability are not either/or situations but can occur simultaneously at different levels (see West, 1985; Bak & Chen, 1991; Lorenz, 1963; Smale, 1980; Thom, 1975). This raises serious doubts about the validity of separate change centred theories and equilibrium centred theories of organisational behaviour as Lauer (1971) has noted. Understanding the dynamics of change means understanding the duality of change and stability. Practically, managers are now having to come to terms with this change-stability dilemma within organisations:

> "How do you simultaneously 'manufacture refrigerators and, on the other hand, plan their obsolescence in order to maintain competitive advantage ?' How do you do this with the same work force and the same management group ? How do you keep the store running profitably while you are converting it into a supermarket ?" (Beckhard & Harris, 1987: viii)

Exploring change phenomenon in atmospheric and climatic systems suggests then, some useful metaphors and ideas for conceptualising change within organisations, and tackling this apparent contradiction. The generation of a new descriptive vocabulary which enables the analyst to 'step outside' of a duality such as this, can often be the key to generating new ways of thinking about a problem.

5.3 CHEMICAL CHANGE PHENOMENA

5.3.1 Introduction

Unlike most change processes in physics, chemistry deals with changes to matter which alter its actual composition and make up. The discipline is based upon the concept of *reaction* - two or more chemical elements changing and being changed by each other as they interact together. This makes it a rich hunting ground for structural change analogies and metaphors applicable at a systems level. Consider the following statement:

> "When a chemical reaction occurs, there are frequently visual signals that something has happened. Colours may change; gases may evolve; precipitates may form. Less obvious are changes in energy which almost invariably accompany chemical reactions." (Sienko & Plane, 1979: 10)

Articulated here are some common properties of change: visual and non-visual manifestations. Unseen change processes may be taking place in the heart of a system, transforming its very structure. Here again we see the concept of energy appearing again - that nebulous emergent property of a system which is so often overlooked and under estimated during change management. Outwardly at the macro level, nothing appears to have changed and yet, inside, new relationships have formed between elements, and old ones abandoned, subtly shifting the balance of power to some new equilibrium state. Failure to notice these changes can lead to inaccurate behaviour prediction and ineffectual system intervention. This highlights the role of the observer and measurement as two important issues which are crucial to understanding the nature of change. They will both be explored further in Chapter 6.

Such are the problems of chemistry. Descriptions and theories of phenomena such as the chemical bonding of atoms and molecules, the electron configurations of chemical elements, and the formation of new chemical products by atom collision offer many insights into the fundamental dynamics of change. Some of these will now be explored. They mostly explore the change processes taking place at an atomic and molecular level. As before, a brief technical description of the phenomenon will be given followed by a discussion of any abstracted change concepts.

5.3.2 Chemical Bonding

Chemical bonds are the those interactions or forces between atoms which hold them together to form molecules. The bondings are also capable of holding together ions, atoms and molecules as more complex structures. They can take the form of very weak dipole interactions (eg: hydrogen bonds), stronger metallic bonds or extremely strong covalent and ionic bondings (Baum & Scaife 1975). The latter two are of particular interest here and are explained in more detail below.

Covalent Bonds

These bonds are formed by two atoms sharing the same pair(s) of electrons. The resulting attraction holds the atoms together. The hydrogen molecule is the simplest example of such bonding.

Ionic Bonds

The creation of an ionic bond is generally considered to involve three steps:

i) By acquiring enough energy, an atom can discard one or more electrons to become a *cation.* (ie: a positively charged ion.)

ii) In a release of energy, an atom can gain one or more extra electrons to become an *anion.* (ie: a negatively charged ion).

iii) The electrostatic attraction of the anion and cation results in the formation of an ionic bond.

It is important to note here that the electrostatic interactions in ionic bondings are not specific for any particular direction.

Chemical bonding as a concept can be used metaphorically to shed some light on the nature and magnitude of forces which hold system components together. Change often involves breaking up existing structures and relationships, and predicting and manipulating the forces that hold them together. To do that effectively, gaining an understanding of what forces are operative at a micro level in a system, and how they are *created*, should be regarded as essential prior to attempting system change activities.

This will involve identifying what attracts system components to each other. It could be the inequality of a surplus in one and a lack in another - resources being exchanged for mutual benefit, thereby forming an association or relationship of an ionic nature. Bonding of this kind describes decentralised, more fluid types of system structure, where there are few internal rules and procedures dictating what relationships and interactions are permitted (non-directional attraction). System components are free to self-organise and establish links with others as seems most appropriate at the time. As a consequence, such systems will have a shifting and evolving structure, as resource ownership and the allocation of surpluses and deficits fluctuates over time. Examples include social and political affiliations within an organisation, networking, or the growing entity known as the Internet or World Wide Web.

Alternatively, the glue holding two system components together may be based on the sharing of resources which neither possess independently. This covalent type of bonding would typically describe a more hierarchical and centralised type of organisation or system. In such a structure, designing and implementing effect change will involve isolating a communal resource which all system components share. Within an organisation, this could be a set of common values; collective experience; or a centralised function like Training. One possible strategy for achieving change in such systems may involve developing a substitute to replace the commonality completely, or merely to wean the system components off it, thereby weakening the unifying bond and making overall change implementation easier to achieve.

At its most fundamental level then, the phenomenon of chemical bonding offers the insight that change can be seen to consist of competing forces of attraction and repulsion operating at a micro level.

5.3.3 Crystalline Fracture

The atoms and molecules of a crystal form themselves into definite, ordered patterns, arranged into regular and symmetrical lattice positions. The precise ordering at the atomic scale is mirrored at the macro level, with the overall geometric shape of the crystal corresponding to the internal symmetry of these patterns. The edges and faces of the crystal are described in terms of axes of symmetry, planes of symmetry and a centre of symmetry (Partington, 1944).

Crystals break into pieces with plane faces meeting at sharp, precise edges. That is, when broken they show cleavage or split along definite preferred directions. This is known as crystalline fracture. It differs from conchoidal fracture which refers to the way amorphous solids like glass break into very irregular pieces. Amorphous solids lack precise, symmetrical ordering in their lattice structure and tend to possess no definite, regular external shape as a result.

An insightful change principle is suggested here, namely that change occurs where possible along the line of least resistance. Nature generally prefers the easiest path, whether it be lightning strikes, river flow or heat loss. This idea suggests that systems which are highly structured and are based on a definite ordering of their component parts, will be more susceptible to change in certain directions. A knowledge of the underlying structural features at a micro level can lead to a greater understanding of how and why systems tend to undergo change in particular areas and ways in response to some external stimulus.

Considered metaphorically, this phenomenon also suggests that 'amorphous' systems with little formal structure or internal framework are susceptible to change in *many* directions. Indeed it could be argued that such systems are more flexible to change (albeit unpredictable), unlike 'crystalline' systems whose internal symmetry and structure largely dictate what changes are permissable. Both Anderson (1972) and Jantsch (1980b) have noted that the spontaneous breaking of symmetries present in a system can generate variety and lead to increased complexity. However, preserving key lines of symmetry can also provide a predictable and controllable means of change along certain strategically useful directions, and therefore should not be eliminated or dismissed arbitrarily.

5.3.4 Noble Gases and Alkali Metals

Group VIII of the Periodic Table are commonly known as the noble gases: helium, neon, argon, krypton, xenon, radon. They are chemically very inactive. Normal attempts to make them react with other elements to create compounds, involving even the most severe reducing and oxidising agents have proved unsuccessful (krypton, neon and radon do react with fluorine and oxygen, but only under special conditions.) There are several reasons for the chemical inertness of Group VIII elements:

- Full outer electron shell configurations mean that there are no free electrons in the bonding orbital to pair with those of another element (ns^2np^6 with the exception of helium - $1s^2$).
- The atoms exist in a stable energy state. Evidence for this is generally seen to be characteristic breaks in the electron configurations for Group VIII elements (see Appendix C).
- High ionisation potentials and small atomic radii cause an atoms electrons to be strongly bound. Small atomic size reduces the chance of electron loss, upon which most chemical behaviour and reactivity is largely reliant.

The combination of these factors means that Noble Gas electron arrangements are very stable, and mostly unaffected by environmental influences. Each atom lives for the most part in isolation, interacting very little with its neighbour (Moeller, 1959).

Group I elements in the Periodic Table, commonly known as Alkali Metals, can be considered to represent the other end of the chemical 'reactivity' spectrum: lithium, sodium, potassium, rubidium, cesium, and francium. Indeed, they lie at the opposite side of the Periodic Table and their characteristics reflect this positioning:

- They all possess a single valence electron in the outer shell. [$np^6(n+1)s^1$ with the exception of lithium - $1s^22s^1$].
- They have a low ionisation potential. This means an atom can easily lose its single electron in the outer bonding orbital.

- They possess a large atomic size and a body-centred cubic lattice structure, with only a single potential bonding atom. This allows electrons to pass between atoms easily, enabling good conductivity, but makes the element soft and gives it a low melting point.

These factors together make for a very reactive set of chemical elements.

Group I and VIII elements then, have fundamentally different persuasions to change. One is extremely stable, almost resistant, the other very open and susceptible. An analysis of the reasons behind these two extreme tendencies, and abstracting the lessons gleaned to a systems level would seem a profitable exercise. As in economics, a model representing each end of the spectrum of possibilities (eg: perfect competition and monopoly) provides a basis for examining and understanding the grey area of reality in between.

A full outer electron shell denotes stability. Viewing a single atom as a system, it can be seen that environmental forces for change can be countered and resisted by ensuring no surplus or deficit develops which could be taken advantage of by some external agent. In addition, the maintenance of strong internal relationships prevents parts of the system from becoming isolated and unsupported. In the case of Group VIII, elements are so stable that almost all interactions are between like atoms, and not with those of another element. This would tend to parallel more closed systems, where environmental exchanges are infrequent.

Large atomic nuclei with available electrons in the outer shell parallel those complex systems which undergo change simply because they appear to have resources surplus to requirements, and have perhaps grown too large, becoming unable to maintain effective internal control and co-ordination over all their component parts. A collection of like Group I atoms develop an emergent property - conductivity - under the influence of an externally applied voltage. In systems terms, because of specific internal characteristics and structural resource configurations, certain environmental influences may induce internal changes within the system by exploiting any instabilities that exist at the micro level.

For example, within organisations such induced change can be seen in the dynamics of hostile takeover bids by aggressive competitors - who may target part of an organisation's operation because it is poorly managed from the centre, and therefore becomes vulnerable when communication to the peripheral business units breaks down. Parallels in the natural world can be seen in lion behaviour, stalking the stragglers of a zebra or buffalo herd.

5.3.5 Electron Configurations

Looking at electron arrangements across all the elements in the Periodic Table (see Appendix C) it can be seen that they all have varying ground or stable energy states. There are seven major shells (or energy levels K L M N O P Q) most with sub shells, with the K (1S) shell having the lowest energy and the Q (7S) shell the highest. One of the basic rules governing how the orbits are filled to ensure the most stable configuration, is that electrons tend to populate the lowest energy orbits first.

As with atoms, the overall stability and tendency to change of a system depends to a large extent upon its internal behaviour and composition. Figure 5.6 shows the number of electrons (cumulative) required to fill each shell in order. Each major orbit (O_n) can be considered to represent a new environment which the system (ie: electron arrangement) gradually moves into as it acquires more resources (energy). Each element can be placed on the graph according to its electron arrangement. Of particular interest here is the location of Group I and Group VIII elements. As can be seen, the most reactive elements (Group I) are located just inside the boundary of a new environment, and the most stable elements (Group VIII) are positioned immediately prior to this transition threshold.

Any system which is seeking to enlarge its sphere of influence and increase its domain of operation, will be at its most vulnerable to change both during and immediately after a transition to a new environment. This is often because its internal structure and behaviour has not yet been able to adjust to the new regime, and the increased stresses and demands (cf: energy level) to which it becomes subject. However, given time, the system will settle into the new environment, adjusting its internal structure and behaviour patterns to become less susceptible to change; less

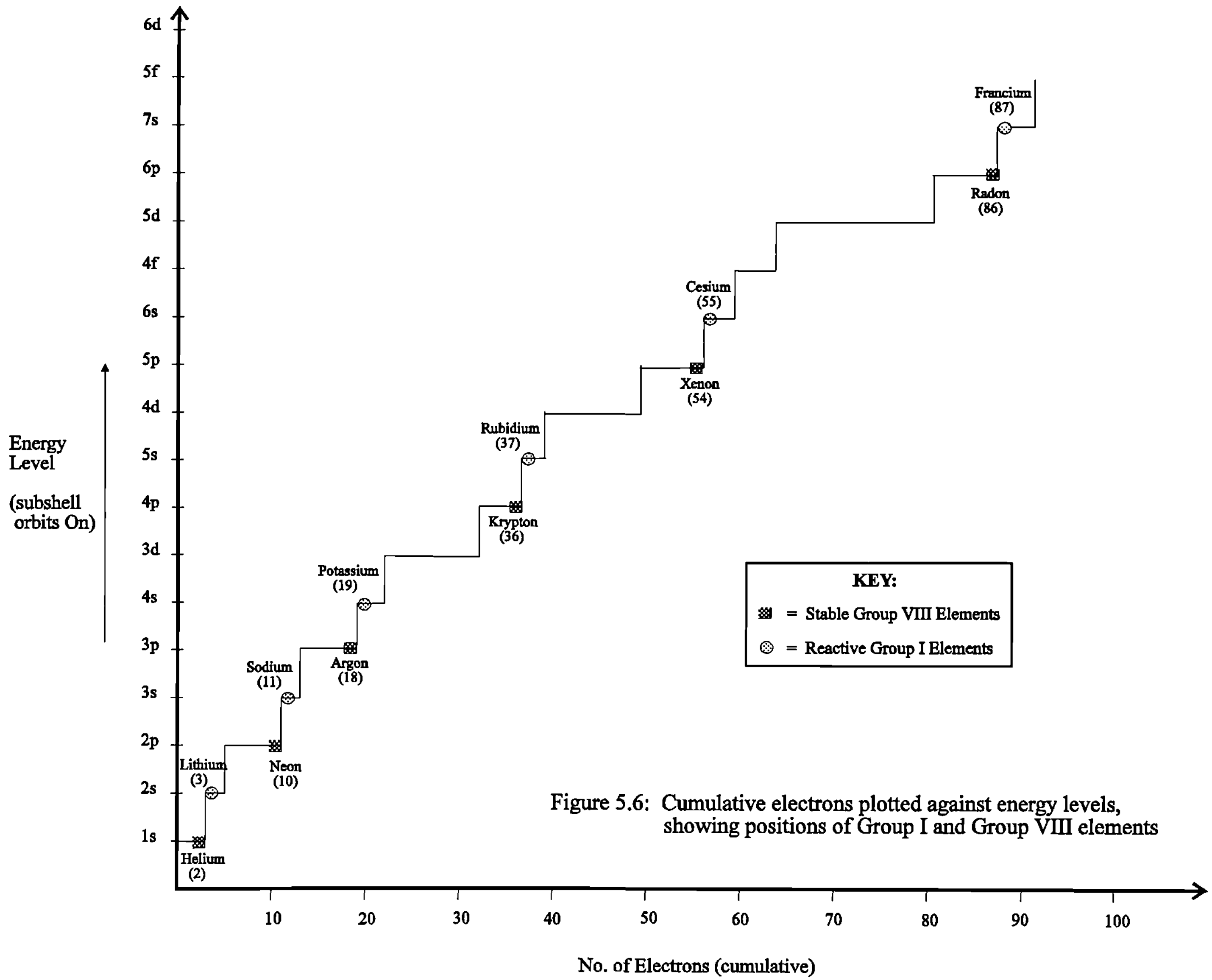


Figure 5.6: Cumulative electrons plotted against energy levels, showing positions of Group I and Group VIII elements

likely to suffer from dramatic encounters with the environment and generally more stable. This line of thinking can be seen in evidence by organisation theorists who follow the Punctuated Equilibrium school of thinking - the organisation experiences long spells of stability which are disrupted periodically by major change that must be accommodated if viability is to be maintained (see Greiner, 1972; Gersick, 1991)

In chemical terms, this phenomenon suggests that a system tends towards the location on the graph occupied by the Group VIII elements. This is the most stable and least reactive group of elements, protected from undergoing change by their internal electron configuration. Systems which are forced to cope with dramatic change can undergo a similar transition. In seeking to survive and adjust to the new state of affairs, they can effectively insulate themselves from external interaction. The end result is that they end up isolated from their environment, cut off from the 'real world', and stagnating in stability or *ossifying* to use the language of one organisational theorist (Stacey, 1993). Gradually lulled into a comfortable, sheltered internal existence, such a system when it realises the error of its ways, finds itself very backward. The outside world has moved on.

Indeed, the system may then forced to make drastic, radical changes in order to maintain viability. Looking at Figure 5.6, it is interesting to note that the elements immediately following those of Group VIII, are Group I elements. The changes required become so radical that the system effectively finds itself undergoing an identity transformation, and entering an unknown environment - and so the cycle continues.

5.3.6 Osmotic Pressure

This is a concept common to both chemistry and biology. Of interest here is the chemical change process taking place at a molecular level. Two solutions of equal volume - eg: sodium chloride ($NaCl$) and pure water (H_2O) - separated by a semi-permeable membrane, will eventually merge to become the same concentration via the process of osmosis. Molecules from each solution will simultaneously pass through the membrane to the other. However, the flow from the least concentrated solution to the most concentrated will be quicker. Osmotic pressure can be defined as the pressure necessary to prevent that flow, and is a function of the relative concentrations of solute ions/molecules in the two solutions. In this instance, to achieve osmotic pressure and prevent the net flow of H_2O molecules across the membrane, an external pressure just sufficient to check the process of osmosis must be applied to the side of the NaCl solution.

From a systems perspective, osmosis can be seen as a process of change, with osmotic pressure acting as a potential restraining influence. The phenomenon of osmosis suggests several useful metaphoric abstractions. Firstly, osmosis has been compared with the process of 'trickle down' in common business parlance to describe one way of implementing change within a system. It has similarities with a concept explored earlier under crystalline fracture - identifying natural tendencies to change within the system and exploiting them. In this case, implementing a change by allowing it to filter through the system via 'osmosis', making use of local imbalances in various parts of the system. If properly designed, the change measure to be introduced can have a two fold effect: successful implementation of the change measure itself and restoration of the local imbalance.

Secondly, examining the metaphor from a different angle, it provides a possible explanation as to why some system changes erode over time, following implementation. For example, intervention designed to move the system into a metastable state via some structural or behaviour change may well appear to have been successful in the short run. However, if the introducing changes set parts of the system at an artificial 'high' in a state well beyond its previous natural equilibrium, a large 'concentration' difference can inadvertently be created. This may cause the system to degenerate back to its previous state, as the osmosis dynamic seeks to eliminate the differential. Fundamentally then, when designing and managing change interventions, if the intervention does not take account of the possible entropic pressures generated by the change, the long run stability and resilience of the implemented change measure must be called into questioned.

However, a third aspect of the osmosis phenomenon which can guard against possible retrograde change relates to the concept of osmotic pressure. If it is known that the system changes are going to deteriorate soon after implementation, an additional counteracting measure could be applied simultaneously, to prevent degeneration commencing, thereby preserving and maintaining the new order of things. Ensuring no retrograde change occurs back to a previous state, and maintaining dynamic equilibrium at the new level is a common problem in system dynamics. Careful design and selection of change measures *and* system objectives which take account of osmotic processes and the pressures and counteracting forces required to offset them are therefore essential.

The fourth abstraction from this analogy relates to system viability and survival. In most biological organisms, the maintenance of osmotic pressure is vital if it is to stay alive. The concentration of albumins in blood plasma is a key component in maintaining the balance of fluid exchange, and hence osmotic pressure. If the level of albumins is not high enough, the concentration of fluid in the capillaries becomes lower than the surrounding interstitial regions, resulting in an osmotic flow of vital fluids out of the capillaries. This can lead to severe swelling, particularly in extremities - a potentially fatal clinical condition called edema. This aspect of osmosis could help explain complete system deterioration over time. Loss of necessary local balances between components and their relationships, could cause seemingly minor internal changes which cumulatively, may undermine system viability. This could be avoided if an analysis is made of key flows at the micro level, what tolerance bands they operate within, and how movement outside those limits will affect the system as a whole. Again, this is another clear example of how a system change observable at the macro level, could well be the result of many minor changes in structure, balance and behaviour deep inside.

5.3.7 Collision Theory

This is the theory developed to explain the phenomenon of chemical change, and is based upon the premise that chemical reactions take place as a result of collisions between the ions, atoms or molecules of the elements involved.

Step-Wise & Concerted Change Processes

So far, this analysis of change concepts in chemistry has covered both the overall change taking place during a reaction (macro) and the nature of bond formation and breaking (micro). Here we will consider a third aspect of change key to the chemist - the timing of electron bond changes.

Put simply, some chemical reactions take place in discrete or *step-wise* phases, involving transitional stages and finite products. Others reactions take the form of a straight, continuous change from one chemical structure to another. The latter are known as *concerted* reactions. It is the timing of the changes that distinguishes the two. Chemists make use of reaction coordinate diagrams, which plot the energy changes that take place during the course of a particular reaction, as the electron bondings break and form. Figure 5.7 shows reaction coordinate diagrams for both step wise and concerted reactions.

These diagrams illustrate the reaction pathway of the reactants. One of the fundamental ideas in Collision Theory is that during chemical change, the reactants pass through an energy or *transition state* that is greater than that possessed by both the original reactants and the final product. These transition states are represented by the maxima peaks in the diagrams, and the temporary chemical structures formed at these points are called *activated complexes*. They do not have completely formed molecules, as the atoms never have a chance to bond fully. In step-wise reactions, the minima between the transition states represent very reactive, high energy intermediate chemical products. Unlike activated complexes, these do have completely formed bonds, but they do not last and the product breaks down as the reaction builds up to the next transition state.

In the normal course of events, not every collision between reactant particles causes a reaction. Some minimum *activation energy* (E_1) is required to excite them and achieve an initial transition state. (Boltzmann's law of energy distribution can be used to determine the number of particles that will possess this level of energy.) However, even having sufficient energy is no guarantee that a reaction will result from a collision, because the particles must be appropriately orientated to each other before they collide (Hazzard, 1973).

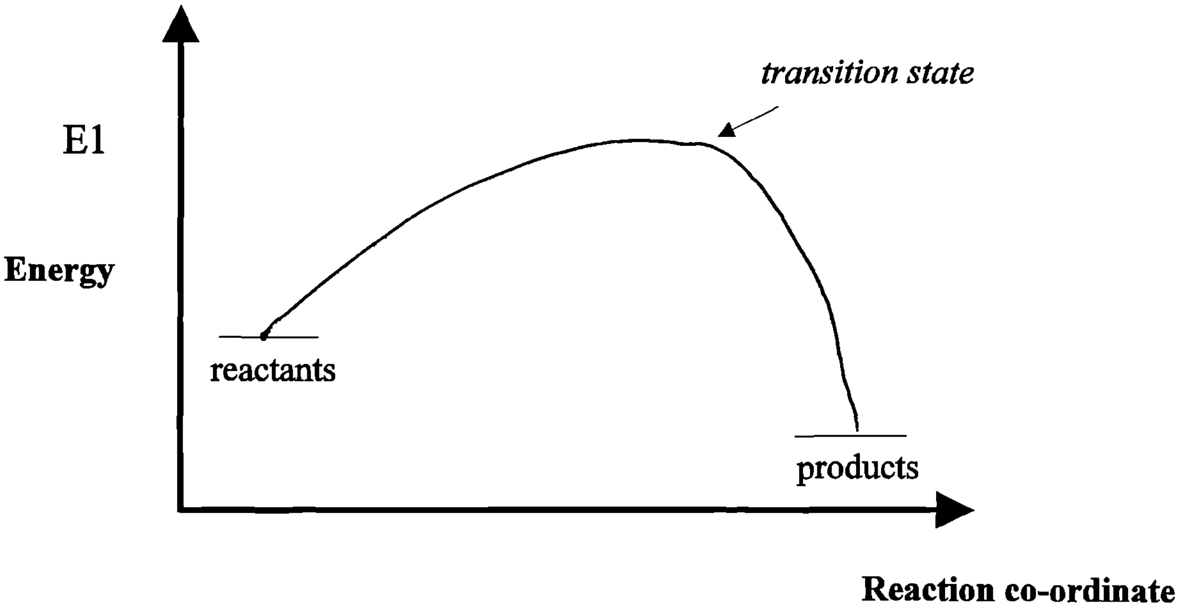


Figure 5.7a: Concerted reaction process

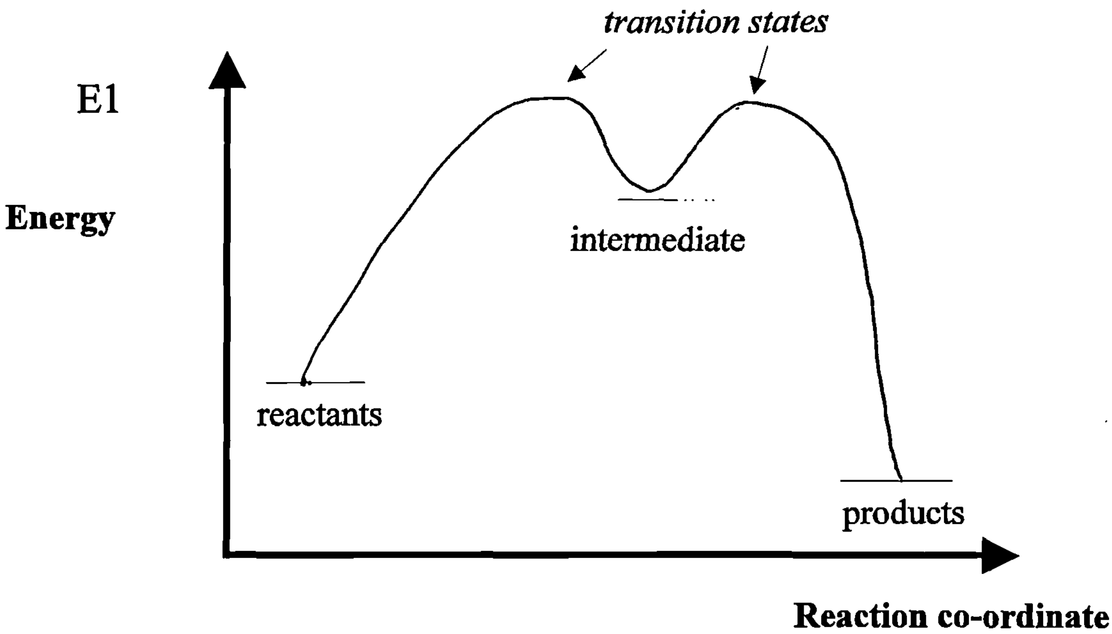


Figure 5.7b: Stepwise reaction process

By raising the temperature of the reactants, the rate of reaction when it does occur, will be greater. Similarly, to reduce the reaction rate the temperature need only be lowered. Therefore, devising effective ways for controlling heat input and extraction from a set of reactants is an important part of chemical engineering. Moreover, the effect of temperature changes on the change of *reaction rate* depends upon the reaction in question, and over what temperature band.

Several interesting concepts within Collision Theory have potential applications at a systems level. Firstly, step-wise and concerted processes suggest two fundamental types of change: the smooth, continuous transition from one state to another in achieving the desired change, or movement through several discrete intermediate states. Of course, this is all relative with respect to time. Indeed, one could argue that there is no such thing as a final equilibrium state beyond which no further transition is possible. Over an infinite time scale, all states move relative to each other and all changes could be classed as step-wise:

> "Somehow the agenda has been put into the form of talking about a set of transitions from state A, the present, to state B that is sustainable. The problem is that there is no such state. You have to assume that the transitions are going to continue forever and ever and ever. You have to talk about systems that remain continuously dynamic, and that are embedded in environments that themselves are continuously dynamic" (Cowan, 1992: 356)

Nonetheless, for most practical purposes, within some given finite time scale, movement from system state A to B could be accomplished in one continuous change, or several intermediate phases. In planned system intervention terms, the common reductionist approach would suggest the latter as the best method, ensuring a tightly controlled, well managed change from A to B. However, there may well be emergent structural or process features in the system at the level of the whole, which could be made use of, to implement the same change in a continuous, one off, concerted way. Collision theory would appear to suggest that the total activation energy required for such a change is less than that for a similar reaction pathway achieved via step-wise reaction. So there could well be potential time and resource savings to be made by making the transition in one jump.

The second idea suggested concerns the energy required to reach a transition state. There is a definite energy barrier to be over come if an activated complex (maxima) is to be reached and passed. To achieve either kind of change (step-wise or concerted) significant resources need to be expended to overcome some internal innate resistance. The notion of resistance will be explored further in the next chapter.

Thirdly, as was stated in the technical description, correct molecular orientation is necessary if a reaction is to start. The obvious systems parallel here is that prior to effecting some change, the system components involved must be appropriately orientated, to ensure the transition takes place as anticipated. Otherwise the initiating stimulus (internal or external) may go unrecognised or be dissipated.

Fourthly, as was noted earlier, the rate of reaction is a function of several attributes, namely temperature, reactant composition and reactant concentration. Similarly the rate of system change can be influenced by many things, both external to it and internal. A better understanding of the dynamics of change will enable those factors which affect rate of change to be identified. Clearly they will vary depending upon the type of system, but if change practitioners are to more accurately control the timing of planned changes in a natural way, they need to take heed of both micro and macro factors which are capable of affecting the rate of change, and ensure the 'activation energy' they provide is in harmony with them. As in a chemical reaction, these must be carefully managed. There is usually a price to be paid for both rapid change (eg: lower take up; less permanent; undesirable changes elsewhere etc.) and slow change (eg: dissipated resource; lack of momentum; prolonged vulnerability; 'too late' when completed etc.). Identifying system variables and components which affect and *are affected by* the rate of change, can help to ensure the most desirable balance is achieved for the system as a whole.

5.3.8 Chemical Catalysts

Chemical catalysts are substances which have the ability to increase the rate of a particular reaction, while at the same time not being affected by the chemical changes they are accelerating. They can provide more rapid reaction pathways involving lower activation energies, and are also able to provide the necessary molecular orientation for the reaction to start.

There are two broad categories of catalysts: heterogenous and homogeneous. The former are typically solids which act externally, attracting particles of the reactant and making them more vulnerable to reaction by weakening their bondings. The latter facilitate the creation of activation complexes from within, and the formation of temporary intermediate products (Baum and Scaife, 1975). Two other associated concepts are negative catalysts and autocatalytic sets. Negative catalysts can be used to slow reaction rates, although this is largely achieved by disabling catalysts already present. Autocatalytic sets consist of reactants where one or more of the eventual reaction products is itself a catalyst for the reaction pathway.

A 'catalyst for change' is a well known expression commonly used in the English language today. It is perhaps the best known change metaphor in every day use, and little can be said at a general level that is not obvious or has not been said before. Stating the applications explicitly, the following can be noted:

- Catalysts assist and speed up the process of change within a system.
- They can act from the environment (heterogenous) directly influencing change processes within the system.
- They can be part of the system itself, working from within to facilitate change (homogeneous).
- Their influence can help to weaken internal relationships (bondings) making the system more susceptible to change.
- Their influence can orientate and prepare parts of the system prior to and during the change process, making new relationships easier to form, and bringing key components into contact with each other.
- They can be used to slow the process of change down (ie: negative catalysts).
- They can be used to generate self-perpetuating change within a system (autocatalytic sets). Within an organisation for example, this could be continuous improvement, quality enhancement, or product development. Kauffman (1991; 1992) has already explored this aspect of change in some detail with computer simulated models.

If these ideas are to be explored more fully within social systems like organisations and taken beyond the shallow rhetoric of the 'catalyst for change' cliche, a rigorous effort must be made to identify specific analogic parallels. For example, for a given proposed change scenario, what internal relationships could be weakened? Which would be most appropriate - a heterogenous or homogeneous catalyst? Will the catalyst chosen be able to achieve orientation prior to the change? Will there be any (dis)advantage to speeding up or slowing down the rate of change? These are the type of questions that need to be asked to trigger deeper thinking, if the catalyst metaphor is going to offer more than just a useful description during practical change management assignments.

5.3.9 Dissipative Structures

Research in the field of Dynamical Systems Theory has investigated in some detail certain chemical reactions and processes classed as dissipative (Prigogine, 1980; Nicolis and Prigogine, 1977). Chemical systems composed of atoms and molecules can be located in a given point in space and time, at a given density. It is well known that such systems normally obey the Second Law of Thermodynamics and tend towards molecular disorder as they seek a thermodynamic equilibrium. However, under certain conditions such systems can exhibit remarkably coherent and organised behaviour. Specifically, the system must:

- Transfer energy with the environment at a level sufficient to offset the progress of internal entropy
- Possess internal feedback loops connecting its constituent parts
- Have far-from-equilibrium or chaotic processes at work within it.

  (Allen, 1981; Jantsch, 1980)

If these conditions are present, at a certain critical point the system can undergo a remarkable change:

> "...characterised by the coherent behaviour of an incredible number of molecules...[and] new organised states of matter, whose importance has now been confirmed for numerous chemical and biological reactions."
>
> (Allen 1981: 27)

These systems have been called *dissipative structures* - based on their ability to exchange energy with their environment, and in so doing change their internal structure from one of increasing entropy to one of order through a process of self-organisation and coherent behaviour. As Prigogine and Stengers (1984: xv) have noted "...order and organisation can actually arise 'spontaneously' out of disorder and chaos through a process of self-organisation." Often, the order and structure will appear at a visible macro level, and will persist as long as the energy transfer with the environment lasts (Briggs & Peat, 1989). Another example is the Great Red Spot visible on Jupiter. This is a persistent feature visible on the planet's equatorial belt through a medium sized telescope - a vast atmospheric storm which has raged for centuries amidst a sea of continually changing eddies and currents. Exchanging energy with the turbulent environment around it, the storm has managed to maintain its shape and structure over time.

Conceptually, the phenomenon of dissipative structures has much to offer. It is closely allied to the notion of self-organisation and suggests that given sufficient energy interfaces with a chaotic environment, a system can establish a dynamically stable identity and structure of its own which is a function of the interdependence between its component parts. Several authors have explored parallels between dissipative structures and organisations. Zimmerman (1992) likens it to the concept of self-renewing organisations (Pascale, 1991; Hedberg, Nystrom and Starbuck, 1976) arguing that organisations must develop the capability to be self-reflective if they are to co-evolve with their environment. Here we see considerable agreement in principle with the growing Critical Systems movement (see Flood and Jackson, 1991c) which also advocates self-reflection within organisations. Zimmerman (1992) goes on to argue that if organisations are to learn and adapt within a turbulent environment they must, among other things, create redundancies and parallel pathways in their internal interactions, and attempt to increase both the number and intensity of external interactions with their environment.

Stacey (1993) discusses the phenomenon of dissipative structure as being midway between the pull towards stability on the one hand and chaotic instability on the other. With respect to organisational systems he likens a dissipative structure to:

> "...consensus on and commitment to the implementation of an innovation, that is a new strategic direction or significant change in some aspect of the business. It requires continual inputs of attention, time and resource to sustain.... Such states are consequently short lived, periodic rather than continuous." (Stacey, 1993: 231)

Wheatley (1992) compares dissipative structures to organisations which maintain well defined internal structural stability, and yet remain open to the environment over time. She suggests as an example, a company which is organised around core competencies:

> "It can respond quickly to new opportunities because it is not locked into the rigid boundaries of preestablished end products or businesses. Such an organisation is both sensitive to its environment, and resilient from it. ...The presence of a strong competency identity makes the company less vulnerable to environmental fluctuations...[yet] wide open to new opportunities and ventures that welcome their particular skills." (Wheatley, 1992: 93)

The phenomenon of dissipative structure then demonstrates that micro level change can be in perpetual creative tension with apparent macro level stability as the two trade off each other, given sufficient energy exchange with the environment.

5.4 BIOLOGICAL CHANGE PHENOMENA

5.4.1 Introduction

Here we enter the realm of living. The somewhat mechanistic metaphors from physics and chemistry here combine with that undefinable quality of 'life' to produce biology. A whole raft of ideas become readily available for systems abstraction at a general level. Biology has traditionally been the hunting ground for useful organisational and systems metaphors. Indeed the whole concept of a 'system', composed of elements, relationships and boundary exchanges attempting to remain viable within a given environment is based on parallels with a biological organism.

Here several biological change phenomena are explored from various areas of the discipline, which provide further metaphorical and conceptual insight into the nature and dynamics of change, and have potential utility in a wider systems and organisational context.

5.4.2 Metabolism

As the following quote demonstrates the process of metabolism is one of the most fundamental driving forces behind change in an organism:

> "The processes of life require transformations of energy to drive chemical reactions. Metabolism, the totality of interactions and changes of molecules and ions within a living organism, is controlled so that the organism is able to maintain its complex organisation by a balance between destruction and synthesis... [and]... change its organisation, as in development."
>
> (Hardin and Bejema, 1978: 37)

At the general systems level the phenomenon of metabolism suggests several parallels. Fundamentally it is a process of energy conversion similar to dissipative structure dynamics, which keeps the organism alive over time. There are two main processes of change taking place in metabolism. Firstly, that which maintains an internal dynamic equilibrium. At a sub-system level, changes are taking place to convert and transform the raw materials required just to keep the whole system in its current state. These change processes are essential to system viability, and although they are mostly unseen, they maintain the systems ultimate emergent property: its *identity* within a given environment.

Secondly, metabolism provides the impetus for change processes that cause the system to change state - ie: reorganise its internal structure, modify its behaviour and cause it to move into a new plane of existence *with its identity intact.* This second aspect of metabolism is crucial if the system is to remain in harmony with its environment. As in the biological realm, if an organism is subject to environmental extremes beyond its ability to compensate, it dies. So with systems generally - they can only adapt in the short run within certain tolerance bands which are a function of their internal structure and 'metabolic rate'. Planned interventions which do not ensure that the systems metabolic infrastructure is able to fuel and maintain the new structures or processes being introduced are doomed to failure. It is important to make the distinction here between one off resource inputs tailored to assist a particular change event, and the essential on-going ability to convert external resources into a form suitable for internal consumption. For example, a baby relies on its mother's milk immediately after birth, and this has been shown to contain a host of essential minerals, vitamins, anti-bodies and nutrients specifically designed to increase its growth and resilience against disease (Harvey, 1988). Later in life, the child must extract these necessary inputs from other foods and convert them itself via the normal process of metabolism. In the same way, an organisation may receive an injection of training and special assistance (eg: consultancy) to help with a particular transformation, but if its long term identity and viability is to be maintained, it must have developed the ability to convert resources into revenue *itself*, through its own internal business processes. Neglect or overstretching of this internal resource conversion infrastructure in the context of an increasingly hostile environment or rapid internal structural growth could be disastrous.

5.4.3 Surface - Volume Ratio: Environmental Exchanges

This aspect of biological life is closely associated with the phenomenon of metabolism. The metabolic processes necessary for living are generally proportional to a cell's volume. A cell's metabolism relies upon exchanges with the environment - ie: ingestion of food and removal of waste products. Environmental exchanges are directly proportional to a cell's surface area. Hence, the surface to volume ratio of a cell is critical to its survival, and is generally maintained within definite bounds. This ensures the metabolic rate remains fairly constant. Should a cell grow in size without a change in shape, it would find it progressively more difficult to maintain sufficient exchanges with the environment, to cope with increasing metabolic needs. As a general rule, cells overcome this problem by dividing periodically.

Some cells have high surface area:volume ratios because of their specialist functions. For example, alveoli cells which ensure high oxygen and carbon dioxide transfer within the lungs. Intestinal villi have a similar property, to facilitate the digestion process. (It is a well documented observation that uni-cellular organisms have a large surface area membrane in relation to their volume. In general, small organisms are better able to satisfy their metabolic needs by diffusion, than large organisms.)

Environmental exchanges are also directly affected by the motion of the environment relative to the organism. Food and predators are typically environmental elements which an organism interacts with during its life. Encountering or avoiding them successfully requires the setting up of some motion between itself and the environment. There are typically three types:

i) The motion of the organism through the environment. This a very common way of ensuring environmental contact. Eg: fish, birds.

ii) The organism being fixed to a geographic locality of environmental movement. Eg: coral (moving underwater currents), spider (web trap) or mussels (tidal flows).

iii) The attachment of the organism to a fixed position, and propelling the environment through its body in a perpetual filtering motion. Eg: sponge and oysters

The clear principle implicit here is that a system has exchanges with the environment which need management. This is not a new idea, but the volume:surface area ratio metaphor does suggest several intriguing implications. Firstly, a system interacts with or 'touches' the environment at certain specific points on its boundary. Depending upon the type of exchange being examined, the interactions could take place:

- At every point along the boundary. Eg: visual perception; predatory action; bankruptcy/liquidation.
- At specific points dictated by forces in the environment. Eg: criminal investigations into an organisation's fraudulent activities; block share buying.
- At specific points dictated by elements within the system. Eg: release of product information by an organisation; joint venture.

Opportunities and influences for change are a function of the degree of contact a system has with its environment. This in turn is partly related to the systems 'surface area', but perhaps of more significance, the actual number of interaction points along its boundary at a given point in time. This is an important distinction because the existence of a boundary with the environment in not necessarily synonymous with contact with that environment, *at a given location* on the boundary.

This metaphor goes beyond what is normally termed 'boundary management' as it raises issues fundamental to the nature of change. Philosophically, there has to be a boundary with something. What that 'something' *is*, largely defines the boundary itself and the type of interactions taking place across it. The perspective and understanding of those involved will also affect boundary and interaction definitions as several theorists have noted (Checkland, 1981; Jones, 1982; Flood, 1987). As was noted in Chapter 2 (section 2.5), Smith (1982) defines organisational boundaries in terms of relationships and environmental interactions, *not* in structural terms.

As far as change is concerned, the important consideration is to what extent the system will be forced to undergo change should the boundary be breached. How likely is it that an interaction will occur? Does the system have control over when or if the interaction will occur, and influence over where on its boundary it will happen? Answers to these questions are essential if a system is to undergo change effectively, as it moves through an infinite 'possibility space', learning and adapting as it does so. Knowledge about what kind of environment lies the other side of critical points on the boundary at a specific point in time would therefore be desirable. An assessment could then be made as to the possible threats and opportunities that would be present, should an interaction take place.

Some systems choose to have their boundaries in particular places so as to minimise or maximise contact with certain elements in the environment, and the subsequent change it may bring. For example:

- flower sellers outside train stations (maximise)
- crabs bury themselves in the sea bed for protection (minimise)
- streamlined aircraft body panels (minimise) or wing span for lift (maximise).

Others systems plan 'temporary exposure' of some of their parts to selected parts of the environment - eg: Public Relations function of an organisation or a submarine periscope. More indirect boundary touching involves mere observation of the environment, and making internal behaviour or structure changes as a result of the perceptions, impressions and interpretations of the changing world outside. These can be considered soft interactions, as opposed to hard interactions involving more direct quantifiable exchanges of actual resources and materials.

An appreciation then, of the dynamics of environmental interaction and the composition of the boundary for a given system, is essential to understanding the forces and sources of change it is likely to be subject to - and how it will respond.

5.4.4 Enzymes as Catalysts

Enzymes belong to a peculiar class of proteins which act as catalysts within a cell, and are essential to maintaining its metabolic rate. Without them, the activation energy necessary to achieve the cells basic chemical reactions would be much higher. Typically an enzyme molecule will posses at least one *active site* which moulds itself to a substrate molecule (when correctly orientated), to perform the required catalytic action. This involves the breaking of chemical bondings in the substrate, and the subsequent release of the substrate products. The enzyme then returns to its original configuration unchanged. This is one explanation of enzyme action and it is called the Induced Fit Model of enzyme - substrate interaction (or Flexible Active Site Model). As with most chemical catalysts, an enzyme is particular to both the type of substrate molecule it will interact with, and the kind of chemical reaction it is able to catalase. Hence the specific direction and rate of metabolic activity within a cell is mostly a function of the types of enzymes it possess (Gerking 1974). An additional important property of enzymes (and all catalysts in general) is that they can only initiate or accelerate a reaction that is already possible energetically (Villee and Deithier 1976).

Catalysts were discussed in detail earlier under chemistry and many of the same principles apply here. However, the Induced Fit Model does provide scope for further system analogy. Boundary interaction as has been discussed, is an important source of change activity and information. Active sites on enzymes provide an excellent example of how to control and manage environmental exchanges, and subsequent change activity. In systems terms, they denote specific locations on the boundary which are designed purely for one particular type of interaction. In this case, it is not system structure or behaviour undergoing change, but rather the system having an influence over its own environment and being able to change it.

Conceptually, there are several insightful principles suggested here:

i) The active sites are in close proximity to the environment, not hidden away deep inside the system. This enables more effective influence and control over the targets for change.

ii) The active sites adapt to fit the targets in the environment. This implies that in attempting to bring influence to bear on complex, unpredictable and highly dynamic environment, rigid adherence to standard procedure may not always be appropriate. Flexibility is essential coupled with an ability to *recognise* possible opportunities to bring about change which will be in the best interests of the system.

iii) Catalysts for change within systems may be best applied to situations where the change is likely to happen anyway, albeit more slowly. Attempting to trigger change processes where there is no 'receptor', or where structural and behavioural factors naturally block change and prevent the catalyst from being effective, is a waste of resource.

iv) Following the idea of enzyme specificity, it would seem targeted change that is tightly defined and local only to one particular area, may be more effective than a general blanket change measure.

5.4.5 Enzyme and Protein Synthesis

Enzymic catalysts, while remaining unchanged themselves following a reaction, do not last indefinitely. As they are a form of protein, they can be used as food and digested by a cell. They can also be gradually rendered inactive by impurities they encounter in contact with substrates. Therefore, a cell must be able to create enzymes itself, in order to maintain an adequate supply of necessary catalysts. Here the role of ribonucleic acid (RNA) will be considered.

RNA is a complex organic compound produced within the nucleus of a cell by deoxyribonucleic acids (DNA), and is essential for enzyme production. There are three types of RNA molecule involved in enzyme synthesis (Alberts, 1989):

Messenger RNA (mRNA): These carry all the essential information required to build the enzyme. They are created within the nucleus directly from the master DNA blue print, and move out into the cytoplasm to transmit their genetic instructions.

Ribosomal RNA (rRNA): These molecules constitute a large part of what are termed ribosomes - organelles within the cytoplasm of a cell which form the platform and centre of activity for enzyme and protein synthesis.

Transfer RNA (tRNA): During enzyme construction, these molecules ensure that the correct 'free floating' amino acids are brought into position at the right place. Their function is similar to that of an adaptor, overseeing the proper formation of the polypeptide chain, as it grows into an enzyme.

This particular genetic process is of interest because it describes how change agents are manufactured. The parallels drawn here relate specifically to the process of generating tools for initiating, managing and implementing system change. Firstly and perhaps most obviously, there must be an understanding of what the change tool is to act upon: ie - what is the object of the change. Coupled with this must be a clear grasp of the nature of the change to be achieved. In enzyme synthesis, this information is all held within the nucleus of the cell, encoded into the DNA, and copied onto the mRNA for transmission to the enzyme construction site.

Secondly, there appears to be three key elements necessary for the effective creation of a change agent:

o **Information**: Instructions or blueprint on what type of agent to build, for
(mRNA) what particular type of change.

o **Assembly Site:** A sound foundation or platform to which the basic change agent
(rRNA) building blocks (amino acids) can be drawn and organised ready for assembly.

o **Construction**: Creation of the change agent itself, making use of the (tRNA) instructions (mRNA) and the necessary raw materials (amino acids) and the assembly site (rRNA).

In organisational terms, the mRNA and tRNA have traditionally been recognised and accepted as being essential to planned change interventions. However, there is insufficient attention given to the crucial role and function of the 'assembly site' (rRNA) of change. Only specific amino acids will match the requirements of the rRNA assembly region. Similarly, with organisational change initiatives, there has to be a careful selection and ordering of change agent components (eg: people, IT systems, advertisements, speeches/announcements etc.) to ensure the final composite change programme is internally consistent and will achieve the desired objective. Clearly not all change agent components will be appropriate for a given change - some will cause unnecessary instability, or have undesirable side effects. Others may not be sufficient to initiate the change in the first place, or conversely, may be too effective and start a chain reaction - taking the change beyond prescribed limits. The stages or parts of a planned organisational change programme need to be assembled so as to present a coherent whole to the rest of the organisation. This means the stages must flow logically and consistently in a measured and orderly way. If the target areas perceive the change programme to be ill thought out, not representative of the actual problems, or lacking in credibility, implementing it may prove difficult.

As with biological catalysts, the final fully assembled change agent must have leverage and influence over the selected change target or it will be useless. Examples of organisational change catalysts include external/internal consultants; employee bonus schemes; senior executive vision articulation; new technology; restructuring; recruiting new management; mapping current business process; deregulation. If these are not matched carefully with the change target the catalyst will at best be dissipated and ineffectual and at worse could trigger some undesired changes which may take considerable effort to counter.

Thirdly, the components of the change agent (RNA) are made within the control centre of the system (nucleus), but they are not brought together and assembled until they are outside (cytoplasm). This is where the resources are located, (free floating amino acids) suggesting that vital input and assistance is required, from the parts of the system which will eventually be subject to the actions of the change agent. This parallels the concept of 'user involvement' in designing effective change measures, and is a strong endorsement for a more facilitative approach to change management consultancy. The 'expert' consulting approach often adopted by some of the large management consultancies tends to prescribe what needs changing, what the change agent should be, and how it should be implemented - with little or no involvement from the areas likely to affected by the changes. While there are attempts being made to shift toward a more facilitative approach within large management consultancies (Okninski, 1995; Walker, 1995) current practice still favours the 'expert' view.

Fourthly, it is interesting to note that all change components (RNA) are created from the master blue print (DNA), within the control centre (nucleus). They are *not* generated locally at the site where they will operate. This suggests that to ensure continuity in system change, all change initiators should be schemed centrally. Arguably, this will prevent the proliferation of change activities, all working in different directions (possibly against each other) without any central coordination. Local input and comment can be gained by passing the centrally administered change agents out to the part of the system affected, for final assembly and implementation.

It would seem then that enzyme and protein synthesis has some rich and interesting ideas for change management practitioners. Conceptually, it also provides insight into how the tension between central and local control can be managed when designing change programmes.

5.4.6 Regulation of Enzyme Activity

The chemical action of enzymes within cells requires regulation to ensure that a steady metabolic rate is maintained. Several methods of regulation are used by a cell:

i) Regulation of enzyme synthesis (Jacob-Monod Operon model: see Hardin and Bajema, 1978)

ii) Regulation of enzyme destruction - role of lysosomes selectively degrading enzymes.

iii) Feedback activation - the chemical change activities of certain enzymes are controlled by the creation of enzyme regulatory molecule complexes. These have the ability to improve the enzymes catalytic abilities.

iv) Feedback inhibition - when the action of a particular enzyme is becoming too prominent, the cell can manufacture regulatory molecules that 'turn off' the offending enzyme.

v) Membrane bounded environments - various organelles within a cell are enclosed in a membrane. This effectively partitions the cell into smaller units, thereby localising the change action of enzymes to specific areas. Feedback control is much easier to maintain over a smaller area. The cell is also protected from the potentially lethal action of enzymes called lysosomes.

Considering change regulation within systems generally, there are several parallels here. Once changes have been initiated within a system, the change agents involved require regulation. With respect to the five cell regulation methods outlined above:

i) Minimise the number of change agents being created and implemented. This may seem all too apparent, but 'overshoot' is a common problem in trying to achieve a desired change:

> "If you are trying to control the natural system, you may suddenly be in a situation where the system is already moving in the same direction as you are pushing and not even know it."
>
> (Finlow-Bates, 1993: 470)

ii) Attempt to reduce the number of change agents *already* at work within the system. Trying to eliminate them completely may be difficult, as they tend to gain a momentum of their own once implemented. Nonetheless, measures can be adopted to offset and counter them, by undermining the premise upon which they operate and thereby rendering them impotent.

iii) Introduce measures that will enhance the effectiveness of change agents already at work within the system. This may involve creating a conducive environment for them, providing a suitable medium through which they can operate, or modifying them so as to target more specifically particular areas of the system. This represents a type of positive feedback control.

iv) There may well be a requirement to reduce periodically the action of the change agent within a system, but not irreversible damage it as in (ii). In such situations, consideration could be given to designing measures which will temporarily 'turn off' the change agent. This can save system resources, as the agent then becomes reusable. In addition, reactivation will probably be considerably quicker than re-engineering and implementing a new set of change agents. A distributed network of dormant agents can be left in place around relevant parts of the system - accepted, familiar and ready for use.

v) Confining the action of change agents can considerably increase their effectiveness, as we have already seen (cf: catalysts). Here, further benefits are highlighted. Firstly, control over their action becomes easier via various feedback mechanisms, if their field of operation is restricted to specific parts of the system. Secondly, the system components due to undergo change are more likely to be encountered if they are forced into close contact with the change agent, via some artificial/natural boundary. Thirdly, parts of the system that could be damaged or suffer undesirable changes are protected, if the change agent is confined to specific areas.

5.4.7 Metamorphosis and Maturation

Metamorphosis (lit: change of form) involves the complete breakdown of an organism's existing structure and behaviour, and from the raw materials, the development of new structures (under hormonal control) ready for the next phase of its life. For example, the butterfly forms from an initial egg into a maggot like larva. Without undergoing any major structural change, it grows in size until it enters the pupa stage, forming a hard chitinous casing around itself. Inside, the structural transformation takes place until finally a butterfly emerges and the casing is shed. Tadpoles go through a similar process, although they reabsorb their tail instead of shedding it. Maturation differs considerably in that structurally, the organism does not change at all. It merely grows in dimensions through a series of moltings which involve a shedding of the exoskeleton - for example eg: grasshoppers and the snakes. In both types of change, however, the organism is particularly vulnerable to predators immediately after the transition, as it waits for its new body to harden.

These two types of biological growth are excellent metaphors for system change. Metamorphosis describes system change involving complete structural and behavioural reorganisation and synthesis. Often, this may not be apparent to the outside observer, as the system appears to shut down and cease environmental interaction. The internal changes are aimed at fitting the system to take on some new role or function. It necessarily involves new types of environmental interaction, behaviour patterns and internal relationships. The driving force and coordinating influence behind the change process comes from inside the system. This type of change is often termed *revolutionary*.

Maturation on the other hand, is more of an *evolutionary* change process. It involves no radical change in system structure or behaviour - just an ever increasing size and dominance. The growth of Japan as an economic power, once it had established its industrial and economic base, is a good example of this type of change. Of note in this metaphor is a continual shedding of that which constrains and restricts growth. The main purpose of the maturation change process is to facilitate this discarding of the old and obsolete, to allow room for the new. In maturation, the two cannot exist together for very long.

Most systems are vulnerable to environmental disturbances both during and immediately after under going change. Metamorphosis and maturation both highlight the importance of designing protective measures to ensure that the changes themselves are sustained, as well as the viability of the system as a whole, during the dangerous re-adjustment period.

5.4.8 Ageing and Death

Continued biological changes within an organism, after it has reached adult stage eventually become degenerative. The organism finds it increasingly difficult to survive in its environment, and becomes more susceptible to predators, illness, starvation or severe environmental disturbances like temperature extremes, flood or drought. Ageing merely increases the likelihood that the organism will die from one of these causes (Hardin and Bejema, 1978).

Theories on biological ageing generally fall into two main groups (not mutually exclusive) :

i) **Genetically Programmed Self Destruction Theory** where death occurs soon after the organism has reproduced (eg: male spinach plant; salmon)

ii) **Random Deterioration Theory** where the organism degenerates due to the cumulative effects of random events that disturb its internal organisation.

System deterioration over time is a change process that is of particular concern. The Random Deterioration Theories suggest metaphorically that system death eventually ensues because the system has been unable to renew its vital structures and maintain internal organisation. In human activity systems, it is often the environment which changes, leaving behind a degenerating system which cannot adjust appropriately, and maintain the essential environmental exchanges it requires to survive.

The Genetically Programmed Self Destruction Theories are more applicable to one off, 'niche' systems, set up to exploit a given situation, and then shut down. In organisational terms, there are many examples of this, particularly in high growth technology areas such as computing or novelty gifts like the Rubik Cube. The change process which initiates the degeneration of such systems is often closely associated with the fulfilment of their prime objective. Carrying the metaphor a stage further suggests that complete or part system death can enable the resources tied up within the system to be released, and reused to birth another system with a different objective and identity capable of exploiting another environment - just as the dead vegetation from a rain forest system falls to the ground forming a rich rotting compost for future generations of plant life. Small, flexible companies organised around core competencies are good examples of such rapid 'life from death' transformations. Lacking a rigid formal structure, such organisations are able to reconstitute themselves to enter emerging markets and even create new markets (Prahalad and Hamel, 1990), reconfiguring resources to support their new identity.

5.4.9 Physical Senses

Consider the following experiment. Place the left foot in a bucket of hot water, and the right foot in a bucket of cold water. Keep them there for two minutes. Then place both feet together into a bucket of warm water. The skin senses in the left will report that the water is cold, while those in the right will give the impression that the water is warm.

It can be argued that in the above experiment, the physical senses are measuring *change*, not the absolute state of the water temperature. System functions which attempt to assess, measure and detect phenomena occurring both internally and externally can be likened to physical senses. Hence, they are also vulnerable to report subjective 'misleading' measurements, based upon the relative *change* in perceptions. Instead of reporting the objective reality of now, they have the potential to report - in an ***anti-positivist*** way - how reality has changed (magnitude and direction) over time. These measurements of change may be conflicting, resulting in an incorrect assessment of the absolute state. This phenomenon demonstrates clearly the epistemological issues discussed in the previous chapter (section 4.2.2) and highlights the associated measurement problems of distinguishing between change in perception and change in absolute state.

5.4.10 Autopoiesis

This refers to the change phenomenon of purposeful self renewal within biological systems, which in the process of transition, maintain internal structure and identity (Maturana and Varela 1972). At a cellular level, the interactions within and across a cell membrane are often cited as autopoietic in nature:

> "...on the one hand we see a network of dynamic transformations that produces its own components and that is essential for a boundary; on the other hand, we see a boundary that is essential for the operation of the network which produced it as a unity." (Maturana and Varela, 1987: 46)

Associated with autopoiesis is the concept of *structural coupling*, where environmental perturbations trigger structural changes within an autopoietic unity.

For example forests and climate can be described as structurally coupled, each causing changes in the other. Structurally coupled autopoietic systems have two important characteristics:

- The interaction is mutual leading to a complex interdependent relationship.
- The actual changes which are triggered in a system by environmental disturbances from its coupled partner, are determined by the systems *own* internal structure.

The environmental disturbance can either cause the system to self-organise back to its original stable state via homeostasis, or the perturbation can cause the system to search for "...new developmental pathways through successive instabilities..." (Sahal 1979: 130). Within biological systems, the latter process has been termed *homeorhesis* by Waddington (1968) and represents more than just adaptation and evolution over time. Consistent with autopoiesis, internal integrity and identity is maintained during a perturbation, but the time scale during which renewal takes place can be relatively short. For example, the plant *Sagittaria Sagitufolia* grows leaves and flowers when on land but is capable of transforming itself into an aquatic form when flooded with water within a few days, and reverting back to land form when the water subsides (Maturana and Varela 1987). The short time scale and reversible nature of the change clearly indicates that this is not adaptation in the traditional sense. Rather, the potential for these major changes is already a property of the plants structure and identity - the environmental disturbance merely triggers them.

In general systems terms, structural coupling and the notion of autopoiesis suggest two fundamental aspects of change. Firstly, that changes initiated within a system following some environmental disturbance can be governed by the internal function and structure of the system itself. This provides an alternative change dynamic to that historically advanced by systems scientists - ie: that internal change is shaped and determined by some external disturbance. Secondly, that change and renewal within a system at a micro level can co-exist with constancy and stability at the macro level - indeed, that the micro level change can be essential to preserving systemic identity and structure over time. Here again we see another example of the pull towards two separate attractors within a system, but here they are operative at distinctly different hierarchical levels, and are complementary.

The phenomenon of autopoiesis is receiving greater attention in recent years among theorists concerned with studying general trends in nature and society, covering areas such as global ecology, social psychology, and cognitive evolution (see Goertzel, 1993; Combs, 1992; Laszlo, 1994) However, there have been at least two attempts to use the phenomenon of autopoiesis specifically to explore the nature of change. In the mid 1970's, Zeleny and Pierre (1976) attempted to develop an analytical framework based upon autopoiesis that supports the notion of discontinuous system change leading to higher levels of development. Their work provided an additional change dynamic to reinforce the Punctuated Equilibrium school of thinking discussed in Chapter 2. Goldstein (1988) has employed autopoiesis as a template through which to investigate resistance to change within organisations. This line of thinking will be further developed in the next chapter.

5.5 SUMMARY AND CONCLUSIONS

This chapter has attempted apply the first part of the GST approach outlined in Chapter 3 to the phenomenon of change. A range of change phenomena from across the physical and natural sciences have been surveyed. Where appropriate, the potential for abstracting concepts to a general systems level has been discussed. Figure 5.8 summarises the principal themes and recurring ideas which have emerged from this review. Taken together with the change perspectives examined in Chapters 2 and 4, change can be said to be a function of a number of things:

- The hidden dynamics, deep structures and logics of change which form part of the fabric of the system.
- The observers standpoint, frame of reference or world view.
- The context or environment in which the change occurs.
- The interaction of random events and fluctuations at the micro level, *with* the prevailing structures, functions, standard procedures and protocols at the macro level.

THEME	PHENOMENA COMMON TO (selected)
Energy	Potential & kinetic energy; isothermal change; collision theory; metabolism; autopoiesis
Metastability	Phase transitions; self-organised criticality; dissipative structures; osmotic pressure
Levels	Crystalline fracture; chemical bonding; atmospheric motion; isothermal change
Entropy	Attractors; kinetic energy; ageing & death; nuclear fission
Critical point	Phase transitions; collision theory; nuclear fission; catalytic enzymes
Degree	Electron configurations; chemical bonding; phase transitions; metamorphosis and maturation
Source (internal & external)	Surface - volume ratio; enzymes as catalysts; dissipative structures; attractors and repellors
Feedback (+ve & -ve)	Regulation of enzyme activity; dissipative structures; attractors; atmospheric motion
Resistance	Chemical bonding; adiabatic change; self-organised criticality; nuclear fission

Figure 5.8: Summary of the main change themes and recurrent ideas from Chapter 5

- The resistance encountered, which defines the limits and boundaries of change: between what undergoes transformation and what remains the same - stable and unaltered.
- The structural features of the host system, which provide it with shape and identity.

This last point is an important one, and has been captured to some extent by the phenomenon of ***structural coupling*** discussed earlier. Forces acting on a system or some component of it, do provide some initial energy and impetus for change, as Lewin's force field model highlights (see section 2.5). However, they do not fully dictate the nature and shape of the change itself. Rather, in causing the system to move from one state to another, it is the existing infrastructure of the system which prescribes the limits and possible end states.

It should be noted here that there are many other change phenomena, perspectives and change descriptions which could have been chosen and examined. Obviously only a limited number can be discussed in this thesis. Nonetheless,.it is the author's belief that they are sufficient to demonstrate the benefits of investigating a given phenomenon across a range of disciplines, highlighting similarities, common themes and conceptually penetrating metaphors. In keeping with the GST approach being followed in this thesis, the next chapter builds on the material presented so far, to construct an initial change framework.

CHAPTER 6

TOWARDS AN ANALYTICAL FRAMEWORK FOR CHANGE

> *"Theoretical simplifications, or generalizations, may serve to identify key features, common properties, or important relationships among various phenomena. But more important, a concept which encompasses a broad range of phenomena may also serve as the anchor for a theoretical framework which, in turn, may catalyze specific hypotheses, predictions or tests."* (Corning, 1995a: 665)

6.1 INTRODUCTION

This chapter draws upon the various change perspectives, definitions and phenomena discussed in previous chapters to construct an analytical framework for change. It represents an initial attempt to pull together many of the recurring themes, issues and unifying ideas about change that have been identified during the course of this research. Figure 6.1 illustrates the structure and various components of the framework as they will be described here. Wherever possible, links to concepts, ideas and change phenomena previously introduced are mentioned (shown in ***bold italics***), to demonstrate the line of thinking in the formation of the framework developed to date. New concepts will be shown in **bold** font.

It must be stressed that the framework being proposed here is by no means considered complete, comprehensive or fully defined. Rather, it is the result of an initial application of the GST approach discussed in Chapter 3 to the phenomenon of change. Nonetheless, this chapter does seek to demonstrate that the framework offers considerable insight into the nature of change at a generic level, and that it constitutes a powerful analytical frame of reference with which to explore social and organisational change specifically. In keeping with the ideals of GST, the framework should be applicable in part to systems across the physical, natural and social sciences. However, testing for *general* applicability is not the objective of this thesis. As stated in Chapter 1, the purpose is to gain a greater insight into the nature and dynamics of organisational change. Therefore where appropriate, illustrative examples will focus upon social and organisational systems, and the formal application of the

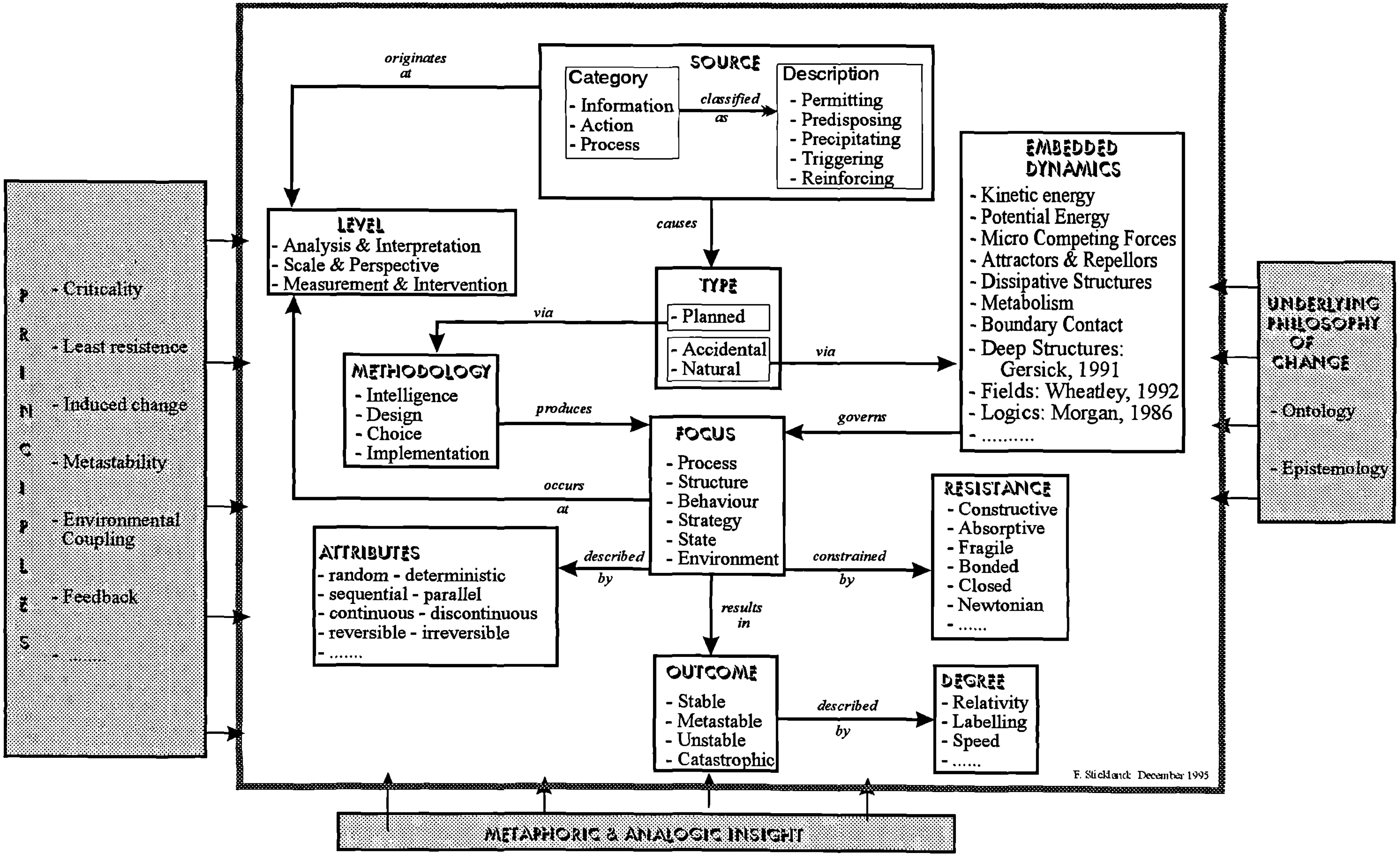


Figure 6.1: Diagramatic summary of the change framework developed and propsed by this thesis.

framework to an organisational setting will be made in Chapters 7 and 8.

6.2 SOURCES OF CHANGE

There has long been a debate about whether causal links for change can be identified and traced at all levels of analysis, particularly with the rise of quantum mechanics. This is an issue discussed later in the chapter. However, regardless of the measurement and epistemological issues, logically change has to be caused by some agent or interrelationship, whether or not it can be identified and manipulated. Sources and causes of change have traditionally been classified as originating inside the system or outside the system as Van de Ven and Poole (1987) have noted. Certainly within social systems, this internal/external distinction stems historically from the nature versus nurture debate within biology and other life sciences: to what extent does the environment drive changes within a system and to what extent is the system in control of its own change processes. Nisbet (1970) has traced this debate back through philosophy and the life sciences, discussing in detail the implications for understanding change - particularly within social systems. The schools of thought described as ***determinist*** and ***voluntarist*** in Chapter 4 underpin the debate about change source and should be born in mind here. From a ***realist*** ontological perspective, incongruencies between reality as it actually exists, and reality as it is perceived to be or 'ought to be', can also constitute a major source of change (see Drucker, 1986).

It is questionable whether the precise cause(s) of a given change can always be identified - indeed some would argue against such endeavours:

> "Arguments over the true or single source of change, while interesting and worthwhile in the sharpening of academic egos, are ultimately pointless. For the analyst interested in the theory and practice of changing, the task is to identify the variety and mixture of causes of change, and to explore through time some of the conditions and contexts under which these mixtures occur."
> (Pettigrew, 1990a: 269)

Nonetheless, there may well be occasions when the actual source(s) of change are obvious or can be accurately determined. Such situations should be exploited to the full. Furthermore, the mixture of causes and sources of change which Pettigrew mentions still need to be articulated and clearly defined, even in general terms. Hence the issue of change sources cannot be completely ignored.

6.2.1 Source Categories

Given that change sources can originate both inside and outside a system several fundamental source categories are proposed:

Information: Access to and the availability of information can be a cause of change - often unseen and taking place at a micro level between system elements, or between systems themselves. Rapid information transmission and communication can cause cascading change within large composite systems. For example, the stock market crash of October 1987 represented change at a number of levels including buying behaviour; expectations and confidence; stock structure; financial positions; share price etc. Such changes have been attributed to the advanced level of information technology, capable of relaying information to traders in different parts of the market virtually simultaneously (Skolmli, 1989; Teweles, Bradley and Teweles, 1992; Kamphuis, Watson and Watson, 1988).

Action: This represents a specific act attributable to a particular system element or a system as a whole, and locatable at a given fixed moment in time. The ensuing change caused could affect the system in which the action originated, or another external to it. For example, the action of an oil tanker captain venting his tanks in mid ocean will cause significant changes to the ecological system in the vicinity. The action of terminating a workers employment will have change repercussions for both the individual concerned and the discharging organisation. Decision making falls under this category, as it can be seen as both a cognitive act in and of itself, as well as *resulting* in specific behavioural actions.

Process: This can be defined as a connected series of actions attributable to one or more parts of a system, or the system as a whole, occurring over a period of time. For example deforestation as a process causes changes within the wider ecological system such as changes in climate and species population. Viewed over a period of years, periodic internal audit reviews within an organisation can be seen as an ongoing process, causing minor incremental changes to working practices and procedures.

It can be argued that over time, there may be a causal link from information to action and on to process. Nonetheless, each category can also represent a specific, individual source of change. Together, they are proposed as a broad analytical base from which to describe both internal and external change sources.

6.2.2 Source Descriptions

Drawing from the work of Miller (1993) in clinical psychology, Coleman, Butcher and Carson (1984) in behavioural psychology and Levy (1986) in organisational theory, information, action and process sources of change can each be further described as follows:

- **Permitting**: Factors which must be present as necessary determinants of change, but not perforce sufficient. (eg: Structural coupling.)
- **Predisposing**: Factors that can increase propensity towards change. (eg: Chemical enzymes.)
- **Precipitating**: Factors that directly precede the onset of change. (eg: Self organised criticality.)
- **Triggering**: Factors which actually initiate the change, following the build up. (eg: Nuclear fission)
- **Reinforcing**: Factors which increase the likelihood of perpetuation following the onset of change. (eg: Autocatalytic sets.)

The change phenomena listed against each source description are examples of where such sources may be identified, and seen at work. Feedback processes may be at work within any of these five descriptions, but particularly in ***reinforcing*** change sources where the transformation needs to be kept going and maintained over time.

Typically, sources of change are analysed in an attempt to build up a deterministic model of cause and effect, in the hope that it may yield some predictive utility. Noble as this endeavour is, cause and effect chains are not always identifiable particularly within social systems, and if they are, they are rarely complete. Organisational decision making based upon the fallacy that such models allow the future to be anticipated and planned for, is fundamentally misplaced. Nevertheless, this should not be seen as justification to neglect an analysis of change sources entirely. The source categories and descriptions proposed here are intended as a means of stimulating and guiding management inquiry - *not* in the first instance for facilitating prediction. Taken together, it is hoped that they provide sufficient conceptual variety to begin exploring the complex web of interconnected sources which can combine over time to produce a given change.

6.3 TYPES OF CHANGE

From observation there would appear to be several basic **types** of change phenomena. These are defined by the degree of conscious intervention and predictability they engender:

- o **Planned**: A deliberate and premeditated intervention designed to change some aspect of a systems normal operation or function. Planned change endeavours are usually achieved via some *methodology*, whether it be explicit or implicit. Methodology will be discussed later.
- o **Natural**: An unengineered indigenous change consistent with a systems life cycle. Natural changes can take place through the vehicle of *embedded dynamics* within a system and these will also be discussed later.
- o **Accidental**: An unexpected, spontaneous change neither part of the natural life cycle or part of a planned action.

Subject to time scale, these three types of change can be considered either **melioristic** leading to negative entropy (Schrodinger, 1944; Kast and Rosenzweig, 1970) and self-organising behaviour, or **pejoristic** leading to disorder and entropic decline. Within social systems such as organisations the emphasis is on affecting changes which are deemed beneficial and in the best interests of the system. From a ***nominalist*** view point however, these are essentially value judgments placed upon a given change; descriptive labels which attempt to associate the implications of the change with the future state of the organisation. At a ***realist*** general systems level such subjective descriptions are meaningless. Of concern here is whether the change has pushed the system towards disorganisation *or* structural cohesiveness and order. Any attribution of value judgements must be based around clear viability criteria. That is, is the change of a pathological nature or will it increase system viability over time. For an organisation, viability criteria may concern revenue generation capability; low cost base; effective command and control structure; efficient process flows etc.

Stacey (1993) has argued that the optimum positioning for an organisation is one where it can operate at the boundary between order and chaos:

> "If the organisation gives in to the pull to stability it fails because it becomes ossified and cannot change easily. If it gives in to the pull to instability it disintegrates. Success lies in sustaining an organisation in the borders between stability and instability" (Stacey 1993: 245)

At this point, it is open to both melioristic and pejoristic change - either type being of potential benefit and capable of increasing system viability, depending upon the options and choices facing management at a given point in time. Viewed in this manner, pejoristic change must not be seen as inherently bad or undesirable. On the contrary, it may be necessary to introduce an element of disorganisation and structural weakness in order to encourage creativity and innovation.

6.4 FOCI OF CHANGE

The **focus** of change is that part or aspect of the system upon which the change is centred or has its main impact and primary domain of influence - ie: that which is changing. Several generic foci are suggested here with organisational and social system examples:

o **Structure**: The various configuration(s) of elements and relationships within a system which give it internal organisation and coherence. For example, within the system of UK Government, the infrastructure of local government is comprised of councils and local authorities; within an organisation, the hierarchical structure which denotes functional division and chains of command, control and communication.

- **Process**: Sequences of related activities within a system which transform inputs into outputs. Within organisations, this tends to be the domain of business process re-engineering type change projects. For instance, within a manufacturing organisation there will be a product manufacturing process involving activities of product design, raw material procurement, product construction and assembly, packaging, distribution and sales. Such a process will typically cross several hierarchical functions, delivering some output for the end customer.

- **Behaviour**: Patterns of action and reaction within a system, at the level of the whole or interactions between individual elements. The obvious example here is organisation culture. Others include social behaviour such as alcohol and drug abuse; consumer buying behaviour; the dynamics of large social group behaviours such as football supporters, fleeing Rwandian refugees and dissatisfied factory workers.

- **Strategy**: The objective(s), strategic goal(s), plan or purpose of a system. For example, a commercial business expansion or market penetration strategy; 'free health care for all' purpose of UK health system; individual hidden agendas present within a group or meeting situation.

- **State**: The set of parameters and variables which define the condition, mode or state of a system at the level of the whole. For example, the general condition or 'state' of the human body can usually be determined by parameters such as blood pressure, pulse rate, respiratory rate etc. Common measures and descriptions of an organisation's state include variables such as cash flow, annual turnover, share price, market share etc.

- **Environment**: Some aspect of the system's environment which it wishes proactively or reactively to change. For example, using individual dress mode to change and affect the perceptions of an 'external' observer; a press release or advertising campaign by an organisation to manage the expectations and buying habits of its customers, placate shareholders or forestall a threatening takeover by a competitor.

These categories are by no means definitive but do capture the main foci of system change phenomenon. In Soft Systems Methodology terms (Checkland, 1972) they represent the domain of the Transformation Process - ie: that which is being changed or transformed.

6.5 LEVELS OF CHANGE

This part of the framework attempts to describe the level of resolution or depth associated with a given change. The concept of ***levels*** of change was a recurring theme among the phenomena examined in Chapter 5. The notion of a sequence of lower and higher levels has been influential in Western thinking since Plato, as Whyte (1970) has noted. Grene (1967) has explored the question of whether "...a one-level ontology [is] adequate to account for the major areas of human experience...". She comes to the conclusion that it is not, and discusses how a many-level ontology can be constructed. Beer (1979; 1981; 1985) has developed arguable the most focused model of the organisation which incorporates the concept of recursive levels. This enables several analytical slices to be taken through the organisation, and basic structural command and control mechanisms to be identified at each one. Bunge (1959; 1960ab; 1963) has proposed nine different types of level and these are illustrated in Figure 6.2. He argues that the concept of emergence over time between levels could occur from low to high levels *and* from high to low levels. Hierarchy Theory has also been greatly concerned with the concept of levels (see: Allen and Starr, 1982; Miller, 1978; Pattee, 1973; Wilby, 1994) as it attempts to describe the relationship between a given observed phenomenon and the observer - across disciplines.

The notion of levels then has been discussed and articulated in detail by many writers. With regard to understanding change specifically, it offers several thoughts that are helpful. Traditionally, change has been viewed at the macro level within social systems, and seen as predictable, linear and gradual (Daniels, 1990). However, with the rise of systems thinking and complexity science there has been a growing

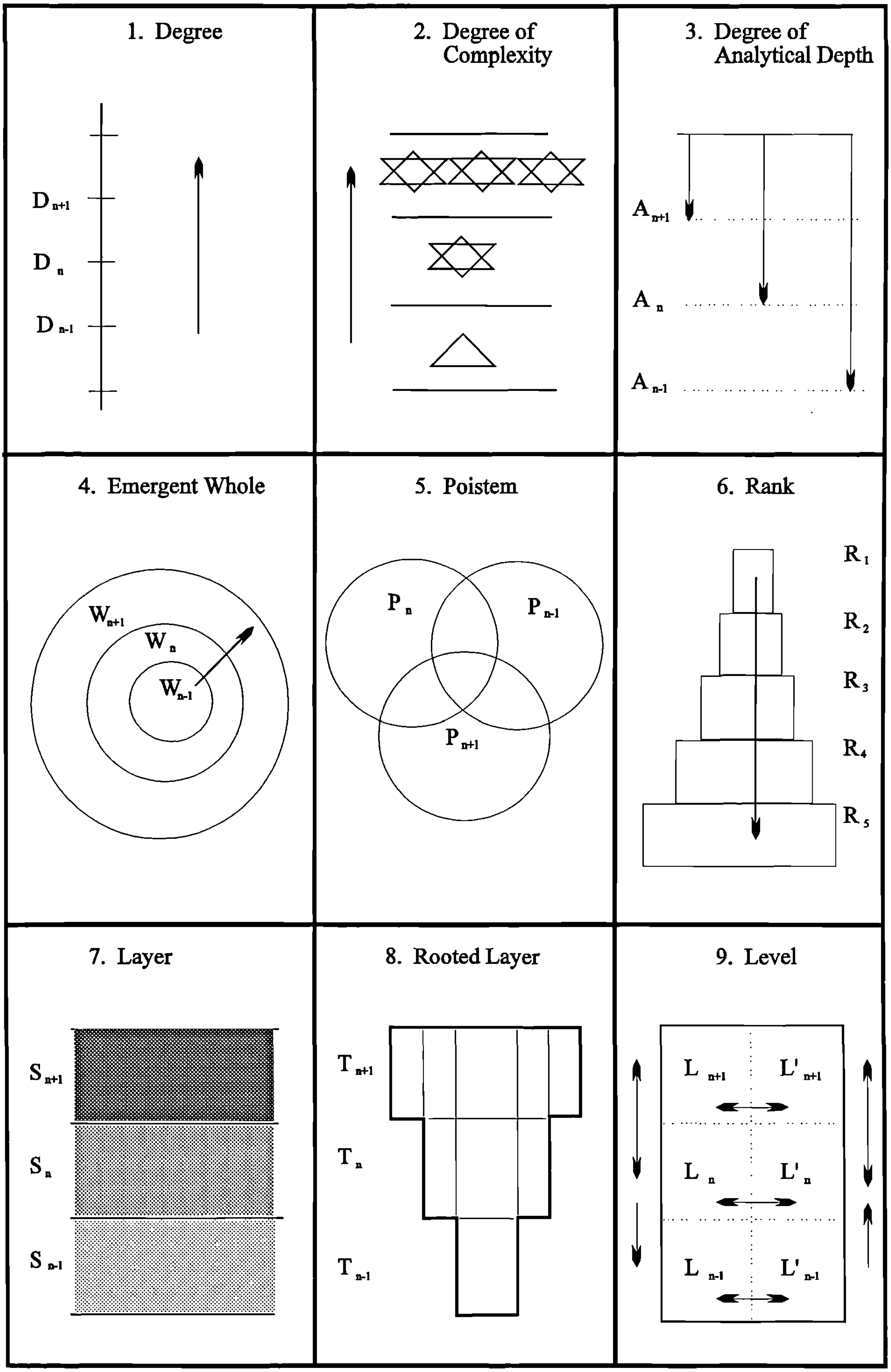


Figure 6.2: Various perspectives on the notion of level (adapted from Bunge, 1960ab)

awareness that short term micro level fluctuations and events are of equal if not greater significance in understanding change dynamics. Phenomena examined in the previous chapter also highlighted this, such as dissipative structures, self-organised criticality and metabolism.

With respect to the notion of change, the term 'level' has several different meanings, specifically: analysis and interpretation; scale and perspective; measurement and intervention. Each of these will now be explored. Firstly, change can be **analysed and interpreted** at differing levels as Berg has observed:

> "A simple dichotomy entails differentiating between surface interpretations (which deal with easily apparent activities and events) and interpretations in depth (which deal with hidden, unconscious, or latent structures and processes)." (Berg, 1979: 52)

In terms of Bunge's classification, category three - Degree of Analytical Depth - is most appropriate here. Clearly the ontological stance of the researcher is of immense significance (***nominalist*** or ***realist***) in determining the actual level at which the change phenomenon is interpreted. For example, the nominalist may interpret change events at the level of the cognitively obvious, limited only by the labels and descriptions available to him. The realist on the other hand may well acknowledge the existence of deeper change dynamics which he cannot directly perceive and analyse.

Wilber (1983) has discussed two types of level associated change, in an attempt to describe the dynamics both in and between levels: translations and transformations. These provide a clear analytical framework within which level related change can be interpreted. Translations concern horizontal movements within hierarchical levels, which perform an important integrating and stabilising function "...filling in or fleshing out the surface structures of a given level." (Wilber 1983: 48). In terms of Bunge's classification, translations would concern category seven and the lateral interactions within category nine. Transformations on the other hand, concern vertical movement between levels, and changes in deep structures which constitute "...the *rules* of the game, the *patterns* that define the *internal relations* of the various pieces to each other." (Wilber 1983: 46 - original emphasis). In biological terms, these two types of level change are akin to morphostasis and morphogenesis respectively (see Smith 1984; Ford and Backoff 1987; Wilden 1980). Taken together, translations and transformations would correspond to the interactions within Bunge's category nine.

Ensuring that the interpretation of a change at a given level is the best possible (***nominalist***) or correct (***realist***), is complicated by the fact that the observer is often an integral part of the system he is attempting to understand. This is a particular problem within social systems. Involvement at the micro level can obscure the macro level dynamics and visa versa. As Quinn and Anderson (1984) have observed:

> "The inability to see the overall phenomenon as an unfolding macro process is closely paralleled by the inability to see the underlying patterns of interconnected, dynamic, cyclical actions which initiate and control the problem." (Quinn and Anderson, 1984: 16)

The identification of structural levels is another way in which change dynamics can be analysed and interpreted. Structure is one aspect not explicitly captured in Bunge's categories. Several theorists have pondered upon the change dynamics between structural levels and the notion of feedback is emphasised by Briggs and Peat (1984):

> "...changes which take place on the micro scale instantaneously effect changes on the macro scale and the reverse. Neither really 'causes' the other in the usual sense. Micro evolution doesn't build up in steps to create a macro evolution, nor do great shifts in macro structures cause the micro world to respond. Each level is connected to the other by complex feedback mechanisms. They cause each other simultaneously."
> (Briggs and Peat, 1984: 26)

While Briggs and Peat were referring explicitly to change dynamics within physical systems, the above quote is also clearly applicable to social systems and interacting human behaviours.

Downs (1967) has gone a stage further in attempting to identify and define specific structural levels at which change occurs. He postulates that social systems - in particular bureaucracies - possess four distinct structural layers, each possessing different propensities to change:

> "The shallowest consists of the specific actions taken by the bureaucracy, the second of the decision making rules it uses, the third of the institutional structure is uses to make those rules and the deepest of all its general purposes." (Downs, 1967: 167)

The second theme which the notion of levels contributes to a better understanding of change is that of **scale and perspective**. The importance and necessity of being aware of the position and time frame of the observer cannot be overestimated:

> "The distinction between 'micro' and 'macro' is one of scale and perspective. An individual, for example, may be a macro structure for a bacterium, but a micro structure for society." (Ford and Backoff, 1987: 110)

Systems science refers to this as *levels of resolution* (Flood and Carson, 1988) and it is closely associated with the concepts of system hierarchy and emergence (category four in the Bunge classification). As discussed in Chapter 4, the speed with which time passes within the system level being examined, relative to the observer, is one aspect that must be taken into account when dealing with change phenomenon. Principles of relativity abstracted from the work of Einstein (1921; 1952) apply equally to any observer - system relationship. The other aspect is the plurality and diversity of information that is uncovered when the scaling is adjusted, and the level of resolution is increased or decreased. As Wilby (1994) has noted:

> "Choice of scale is determined by the observer and that choice defines the hierarchical structure revealed, processes within the system, and interrelationships seen within the system's structure. Any change in the resolution used to examine the system alters the definition and the information gained from the study. It also effects a bias on further description of the system in that alternative perspectives, and possibly radically different system descriptions, can be obtained by altering the scale and resolution of the study." (Wilby, 1994: 660)

This leads on to the third aspect of levels: **measurement**. Failure to give due consideration to scale and perspective when studying change, can result in measurement difficulties. Consider the problems faced by climatologists, who:

> "...tend to think in global terms since that is the scale at which weather generating processes operate. Limitations of data and technology result in

> their models making predictions at a regional scale at best. ... Most measurements of the responses of organisms to their environment are made on an organism scale or smaller, because of the technical difficulty and expense of working at a larger scale." (Scholes, 1990: 351)

As a result, theorising about change phenomenon takes place at one level, but actual measurement and analysis to validate any theories generated, occurs at another level - one which is easy and expedient to access. This results in a gap between theoretical progress and practical endeavour. Scholes (1990) argues that this can be overcome in principle by measuring change phenomenon at the level or scale at which they occur, wherever possible. Failure to do this can lead to key change dynamics and processes being missed. As one commentator has noted, essential to effective change measurement is:

> "...amassing detail on the correct scale to perceive the phenomenon under examination. Look at the world in detail too fine grained, and its common sense rules vanish into quantum interference; look at gases in too fine detail and the thermodynamic concept of entropy vanishes, taking much of what is meant by time with it. The whole notion of what is simple and what is complex depends upon getting your point of view correctly course grained." (Economist 1994: 107)

Some traditional disciplines measure behaviour and change dynamics at the micro level in a ***positivist*** manner, through the lens of the macro level. For example, economics has traditionally employed macro aggregates and econometric representative agents to describe and account for micro economic activity. Hayek (1988) and Pearce (1994) have identified two weaknesses with this approach to measurement. Firstly, having identified and defined the macro level measures of change activity, there is a tendency to relate and connect them together. However, this would seem inappropriate as Pearce has noted:

> "Why, in a complex system, should there be any stable relationship between aggregates that are the product of many changing relationships between individual agents? Clearly, any complex system will have emergent and aggregate properties and many of the emergent properties will in turn feed back to the behaviour of individual elements of the system." (Pearce, 1994: 105)

Secondly, in identifying macro aggregates within complex systems, hard statistical methods are often used, which are not subtle enough to capture the intricate dynamics at the micro level. This can be due to the inherent difficulties of measuring change variables at the micro level, but whatever the reason, the resulting macro measures are likely to be epistemologically unrepresentative of all the change dynamics occurring at lower levels. After all, the 'sum of the parts is greater than the whole' but the introduction of statistical measurement with its susceptibility for cumulative averages and aggregates can often obscure the logic of this well known adage.

6.6 METHODOLOGY FOR PLANNED CHANGE

Oliga (1990: 161) has defined a methodology as "...a method of methods that examines systematically and logically the aptness of all research tools...", - that is, how a given set of problem solving techniques, methods and modes of inquiry are ordered, and applied to a particular target domain. For change types which are ***planned***, there will be some methodological approach or set of steps which the change initiator will go through. These are often explicit and predefined, as in for example, organisational change methodologies such as Total Quality Management, Business Process Engineering, Soft Systems Methodology or System Dynamics approaches to change. Such methodologies typically go through four broad stages, identified by Simon (1960) as essential planned methodological activities:

- **Intelligence**: identifying, defining, shaping and structuring problems - understanding the *context* of the planned change.
- **Design**: generation and synthesis of alternative options, solutions and designs - designing the *content* alternatives of the planned change.
- **Choice**: decision making to compare, assess and choose between the alternatives generated - deciding upon the change option to implement.
- **Implementation**: bringing about the change decided upon and making it happen, followed by monitoring and feedback to assess how successful the change was - making adjustments where necessary.

As was noted in Chapter 4, some change methodologies are of a ***nomothetic*** nature, seeking to identify during the design phase the optimal, 'correct' change action to pursue based upon some unitary world view. Implementation is usually performed in a positivist, scientific manner. Within social systems, approaches associated with Business Process Re-engineering and System Dynamics fall into this category, along with the social engineering approaches described by the National Science Foundation (1972), Boguslaw (1965) and Hoos (1976). On the other hand, other methodologies bring planned change to bear upon a given change ***focus*** in a more ***ideographic*** manner, where the plurality of human perception is acknowledged and emphasis is placed upon the soft relational nature of change within systems. Examples of such change methodologies have been described by Checkland (1972), Mason and Mitroff's (1981) Strategic Assumption Surfacing and Testing (based upon the work of Churchman, 1979), and the more recent approaches of Soft Operational Research (see for example Lane, 1993; Forrester, 1994).

6.7 ATTRIBUTES AND CHARACTERISTICS OF CHANGE

This part of the framework describes different characteristics and attributes which define the various ***foci*** (section 6.4) of change, whether it be structure, state, process, environment, behaviour or strategy. They are all represented in terms of four dimensions, namely: random - deterministic; sequential - parallel; continuous - discontinuous; reversible - irreversible. Figure 6.3 illustrates each diagrammatically.

6.7.1 Random - Deterministic Dimension

This attribute describes to what extent the change is an expected, logical and predictable event, or alternatively the result of 'random' interaction within the system. Allen (1981) has suggested that there are certain types of change process which involve both random and deterministic mechanisms, citing examples in economics, urban development and international relations. These have been referred to as 'order by fluctuation' change phenomenon (Nicolis and Prigogine, 1977). Leading up to the change, the system follows deterministic laws until immediately prior to the transition where ***triggering*** (section 6.2.2) random fluctuations and stochastic mechanisms within the system take over, shaping the nature and direction of the ensuing change.

There are several issues here. Firstly, there is the question of true *randomness*. Can a given change ever be considered inherently unpredictable and random or is it merely

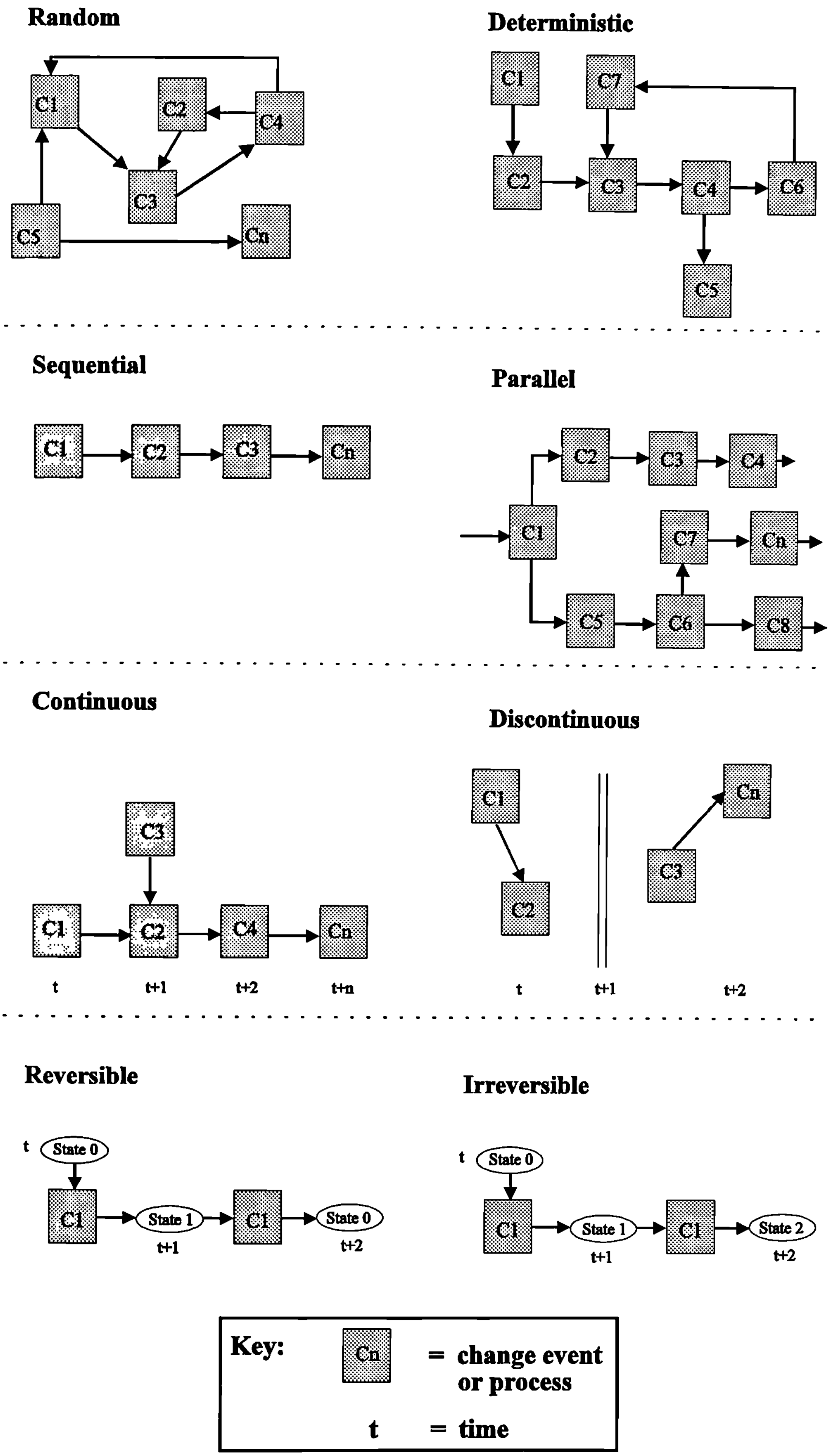


Figure 6.3: Various representations of change attributes

considered random due to the complexity of interactions and the observers inability to note cause and effect ? Within the physical sciences the latter view was held for several hundred years from Newton up until the advent of quantum mechanics. It was believed that "...the world cannot *change* in any way; the available paths for development are constrained to those that conform to the laws." (Davies, 1980: 22) In principle, observational inadequacy and the inability to measure accurately were seen as the reason for apparent randomness. Even Einstein believed that it was ignorance of actual, true causes which give the impression that certain actions are random and that humans have free will (Einstein and Besso, 1972).

Now however, progress in the field of quantum theory has demonstrated that at the level of the atom, change does not occur in such a deterministic way. Heisenberg's famous Uncertainty Principle has been influential in reinforcing this new view. According to one prominent school of thought known as the Copenhagen Interpretation (after Niels Bohr, 1948), the role of the observer and system interventions to measure and extract information, cannot be done without changing the system itself. Consequently, as one physicist has noted "...the relevant entity to consider is always *system observed plus measuring instruments*, so that a change in the disposition of the measuring instruments, even without a change in the system observed, is considered to create a totally new situation." (Polkinghorne, 1984: 93). While the Hawthorne studies (Roethlisberger and Dickson, 1939) demonstrated that a similar phenomenon can occur within social settings and organisational systems, the full implications of this for human activity systems generally have yet to be fully explored. Chaos theory (Bai-Lin, 1984) has also shown that dynamic feedback mechanisms within nonlinear complex systems can produce apparent randomness in behaviour, where the ability to note cause and effect is lost in the continual flux of dynamic and chaotic processes.

The second issue relevant to the random - deterministic attribute dimension of change concerns the effect of the passage of time in obscuring the causes and sources of a given change phenomenon. Context and history may hide deterministic cause-effect chains leading up to the eventual change under layers of events. Pettigrew (1987a) argues that when analysing change within organisations, one must be aware of the extent to which the change is *embedded* within some environmental context - which must be fully explored, if the dynamics of the change itself are to be fully understood.

Thirdly, some systems possess very slow moving, deep change events and processes (Foucault, 1972), that exist far below the gaze of the most discerning eye. These can often pass unobserved until they cause a ripple or change phenomenon on the 'surface' of the system at the macro level. Because no obvious cause-effect chain can be established, the phenomenon is likely to be described as 'random' when in fact it could well be deterministic in nature. The fields of archaeology, seismology, cosmology, history and climatology exhibit such slow moving change phenomenon, which require enormous elongations in time frame for analysis to capture the causal links and build up to the eventual observable change event. It is therefore possible that what may appear to be random change in the short term, may be shown to be deterministic with hindsight when the cause and effect links have become apparent.

Fourthly, a distinction is made here between the occurrence of random ***sources*** of change (section 6.2) and random, unpredictable ***foci*** change (section 6.4). For example, a random disturbance from the environment can set off deterministic change within the system in response (eg: an unexpected knock on a snail shell will cause the resident to change shape in a predetermined and predictable manner - withdraw inside its shell as a reflex action.) Conversely, a perfectly predictable environmental source can trigger a series of random, indeterministic changes within the system (eg: the detonation by France of a nuclear device in Polynesia in September 1995, although preannounced and publicized several weeks in advance, caused a series of unpredicted behaviours such as public disorder, looting and violent protests in the short term and political isolation, diplomatic upheaval and even foreign policy changes during the months that followed.

It should be noted here that deterministic change does not always imply purposeful behaviour. The predictable change in position demonstrated by the regular swinging of a pendulum bob clearly illustrates this. It is not the intention here to provide a detailed analysis of teleological issues. If a given system is said to be purposeful, then any change it may undergo (regardless of ***type***) prompts a debate about whether that change was or is in the best interests of the system as a whole, and in accordance with the system's purpose. Such a debate diverts analysis away from exploring the fundamental dynamics and processes of change, which is the subject of this thesis. Instead, investigations would focus on the attribution of value judgements, attempting to describe whether the change was intrinsically 'good' or 'bad'. Certainly, the role of purpose in initiating change should not be ignored. Autopoietic systems for example (section 5.4.10), demonstrate how important system purpose is in maintaining identity over time. Nevertheless, debating the intrinsic worth of different types of change in terms of system purpose and objectives, is beyond the scope of this research.

For the purposes of this thesis, it is assumed that change ***types*** which are ***planned*** and ***natural*** within social and organisational systems, are essentially purposeful, while those which are classified as ***accidental*** are not.

6.7.2 Sequential - Parallel Dimension

Does a given change phenomenon follow a progressive, linear cause and effect pattern, or is it composed of multiple and interdependent change events occurring simultaneously across the system? The notion of interdependence within and between systems has been highlighted by a number of disciplines, ranging from international relations (Keohane and Nye, 1989); chemistry (Maturana and Varela, 1987); economics (Pearce, 1994; Arthur, 1994) to social history (Bahm, 1979). Indeed, Bahm describes the significance of this change attribute well:

> "Conceiving causation of particular events and processes as not only multi-levelled, but possibly omnilevelled, the complexities of seemingly simple causation becomes obvious. ... Understanding the omnipresence of the whole-part causation seems essential to the economics of interdependence. As multi-level organisations become more intricately complex, each change, deficiency, disease, or destruction in any part tends to become more serious as it endangers other parts and wholes." (Bahm, 1979: 136)

Wimsatt (1980) even goes so far as to suggest that the notion of levels and hierarchy within systems thinking has been an impediment to recognising and understanding multilevel interdependent change across systems. This change attribute then, seeks to highlight whether a change is part of a linear chain of events within a given domain and time frame, or whether it is enmeshed within parallel and interconnected streams of change activity.

6.7.3 Continuous - Discontinuous Dimension

This characteristic endeavours to describe the extent to which change phenomenon within a system are related in time and space. Does the change occur in a smooth, constant and uninterrupted flow of events, or is characterised by discrete, sudden and separated change events, lacking in continuity? The Step-Wise and Concerted change processes of Collision Theory (section 5.3.7) demonstrate this distinction well. As with the Random-Deterministic attribute discussed earlier, the time scale and level of resolution are important here. What might appear to be an isolated, discontinuous change event or series of events over a short timescale, may be fundamentally related to other similar changes occurring outside the observers time horizon or at another level of resolution, forming part of a continuous change process. Indeed, Lenz and Engledow (1986) suggest that an organisations environment is continuously in a state of transition, but that internal observers only perceive change as discontinuities because of the cognitive constraints they are subject to: "...what executives reference as new competitive realities are probably new meanings assigned to continuous adjustments." (Lenz and Engledow, 1986: 343) Similarly, continuous change events may share a common ***source*** but could differ in ***type*** or ***focus***, causing the observer to view them as unrelated and discrete incidents.

6.7.4 Reversible - Irreversible Dimension

Is a given change permanent and unalterable, or can it be reversed and the system put back to its original state? This change attribute has been widely debated over the past century, particularly within the physical and natural sciences. Classical Newtonian physics believed that change was inherently reversible. Indeed, Einstein argued that the concept of irreversibility "...is an illusion, a subjective impression, coming from exceptional initial conditions.... There is no irreversibility in the basic laws of physics." (Einstein and Besso, 1972: 203) However, as Prigogine (1981) has argued, time orientated changes such as those found in chemistry and biology are largely irreversible. If a change is to be reversed, knowledge of the initial conditions that lead to the change must be obtained. But as conceptual advances in quantum theory have shown, this is not possible in practice:

> "Theoretical reversibility arises from the use of idealisations in classical or quantum mechanics that go beyond the possibilities of measurement performed with finite precision. The irreversibility that we observe is a feature of theories that take proper account of the nature and limitations of observation"
> (Prigogine, 1980: 215)

The concept of entropy - a measure of disorder (or more formally a measure of the unavailability of system energy to do work) - is closely associated with this change attribute. According to the Second Law of Thermodynamics, the entropy of a closed system will increase with time. As a consequence, entropy will in part determine the direction of ***natural*** change in a closed system. Wheatley (1992: 76) has described entropy as "...an inverse measure of a system's capacity for change." Most changes require energy to move the system from one state to another and therefore low entropy is usually necessary if change is to be achieved - particularly when little external intervention and environmental exchange is possible.

At a macro level within social and organisational systems, certain change types within a given ***focus*** are somewhat reversible but not without causing other changes within other foci. For example, a planned change of corporate structure could be implemented and then reversed back to the old original structure several months later. On paper, at a macro level reversibility would have been achieved. However, it could well cause behaviour and process changes at micro levels within the organisation, and could even affect the overall state of the organisation. Staff become unsettled; productivity and employee morale fall; corporate credibility suffers. These are all changes from the original initial conditions and so theoretically, although the structure change may be reversed back to what it was, the overall result must be deemed fundamentally different from the initial organisational reality.

So for short term, macro level analysis, approximate reversibility becomes possible within social systems, but over the long term and considering all levels, change must be regarded as irreversible.

6.8 DEGREE OF CHANGE

The degree, severity or extent of a given change phenomenon is an area in which many labels have been freely and liberally employed. From an ontological point of view, the efforts of theorists in many disciplines in documenting degree's of change have resulted in a bewildering array of names, classifications and labels. Two common themes have however, emerged from these classifications: the distinction between first and second order change (Levy, 1986; Krovi, 1993). Figure 6.4 summarises some of the main characteristics of first and second order change. As can be seen, it essentially a measure of how radical the change is in terms of altering the identity of the system. The phenomena of first and second order phase transitions demonstrate certain aspects of this distinction, as does the difference between the periodic radical structure and identity change of biological metamorphosis versus the more sedate gradual development change of maturation.

Another way to distinguish between first and second order change is through the notions of system improvement and design. Van Gigch (1974: 2) has defined system improvement as "...transformation or change which brings a system closer to standard or to normal operating conditions ...[and] carries the connotation that the design of the system is set, and that norms for its operation have been established." 'Improvement' defined in this manner equates to first order change. It should be noted the term implies no value judgement about whether the change is beneficial or harmful. System design on the other hand, describes a more fundamental change, with significant implications for system identity: "Design is a creative process that questions the assumptions on which old forms have been built. It demands a completely new outlook and approach..." (Van Gigch (1974: 2). This is clearly more akin to second order change.

There are two other aspects to the 'degree of change' debate that need to be considered. The first relates to the apparent *speed* of the change relative to the observer. This captures the cliched distinction between slow, incremental change and more rapid change. First order transitions are often associated with slow change and second order transitions with more rapid change. However, the apparent rapidity of the passage of time must not be allowed to confuse events and obscure fundamental

First Order Change	**Second Order Change**
Quantitative change	Qualitative change
Change in one or two levels (usually individuals & groups only)	Multi-level change (individuals, groups & whole organisation)
Change in one or a few dimensions, aspects or components	Multi-dimensional, multi-component change
Change in content	Change in context
Change in a few behavioural aspects (attitudes, values)	Change in all behavioural aspects (attitudes, values, norms, beliefs, perceptions, expectations, and behaviour)
Reversible change	Irreversible change
Continuous change in the same direction	Discontinuous change, taking a different direction
Incremental change	Revolutionary jumps
Logical & rational change	Apparently illogical and irrational change
Change *within* the prevailing world view or paradigm	Change that *breaks* with the traditional world view and creates a new paradigm
Change within the old state of being	Change that results in a new state of being

Figure 6.4: Attributes of first and second order change within social systems
(adapted from Levy, 1986)

dynamics of change. Events compressed into a short time period may in fact only constitute first order change, but for the observer at the time they can appear far more radical - due to the inability to follow cause and effect. Similarly, second order change can occur over long periods of time and as a result go unnoticed by the observer, who may only be conscious of changes within his own much shorter time frame and which taken in isolation, display all the characteristics of incremental first order change. As Van de Ven (1987) has noted, time must be regarded as a key historical metric when studying the dynamics of systems.

The second aspect which has caused difficulty in defining a common terminology for assessing degrees of change is the *position* of observer relative to the system - in both time and space. For example, consider what are often interpreted as quiet, stable periods of human history such as the so called "Dark Ages": AD 500 - 1000 and the formation of the American Colonies: 1730 - 1850:

> "On closer inspection, these periods turn out to have been periods of great fundamental growth and of the enrichment of the ensemble of learning resources and possibilities, which then in turn led to the emergence of novel and temporary more relevant patterns. In the subsequent phase, these new patterns turn into temporarily fixed sub-assemblies. The subsequent age thus may impress observers with its apparent conservatism and stability, while at the same time embodying continued and important processes of change."
> (Deutsch, 1966: 171)

Different reference points and historical standpoints give different perspectives and images of change. Perceiving whether a change is first or second order and what descriptive label to give it, will then to some extent, be a function of the observers position in time and space, relative to the change phenomenon or ***focus*** of the change itself.

Hence, at the heart of this difficulty in defining degrees of change are fundamental issues of measurement concerning the role and position of the observer. This takes us back to the ***realist - nominalist*** ontological debate discussed in the Chapter 4. As Dimond and Ellis (1989) have noted, measurement is based on the conceptual activity of comparison:

> "Measuring the concept of change can only take place in a physical reality by being able to deal with the observable, through the sense impressions of the individual, that is applying properties of objects and events in such a way as to make them measurable and, hence, taken to have the ability to describe those characteristics of the system under investigation"
>
> (Dimond and Ellis, 1989: 49)

However, the subjective nature of human sense impressions can result in a plurality of perceptions, providing a range of descriptive labels for the same change phenomenon - each individual assessing the change according to their own internal criteria and experience of similar phenomena elsewhere. Labels to describe what is perceived to be greater and greater degrees of change abound: incremental; progressive; fundamental; radical; revolutionary etc. The search for more dramatic, all-encompassing adjectives develops into a semantic game, which becomes ever more difficult to sustain as they are gradually exhausted. For example, some recent research undertaken to explore the economic, social and political changes taking place in Eastern Europe since the end of the Cold War (Kamall, 1994) found existing change models and labels incapable of capturing the enormity of the transitions that had occurred and were still occurring. Kamall considered creating new labels such as 'hyper-change' and 'meta-change' but concluded that this would only exacerbate the current confusion and fail to address the real need: a change framework which would describe the fundamental nature and dynamics of change, clearly delineating at a systemic level the various properties and attributes change phenomenon can possess.

The presence or absence of some universal, unchanging reference point - the focal issue in the ***positivist - anti-positivist*** epistemological debate discussed in Chapter 4 - is key to this aspect of the change framework. If the anti-positivist stance is taken, then no common reference point for comparison exists and therefore, a generic 'degree of change' measure across different system types and change phenomena is not possible. Reality "...can only be understood from the point of view of the individuals who are directly involved in the activities which are to be studied" (Burrell and Morgan, 1979: 5). Change can then be understood using the framework discussed here as a rich source of descriptive metaphor and analogy, to assist the change labelling process. However, the positivist on the other hand, can use the various classification components of the framework (eg: source, focus, type, outcome etc.) as points of reference against which to make assessments and comparisons between different degrees of change. Hence, it is anticipated that the framework outlined in this chapter will be of use regardless of one's epistemological stance, in labelling and describing change.

Three aspects of change ***degree*** have been considered here then: namely perception issues concerning the ***speed*** of the change, ***relativity*** issues relating to the position of the observer with respect to a given change phenomenon, and also the epistemological utility of the framework as a means of overcoming the difficulties of ***labelling*** and describing change.

6.9 EMBEDDED DYNAMICS OF CHANGE

Having surveyed a range of change phenomenon in the previous chapter, several fundamental concepts emerged which can be said to describe engines of change that form part of the very fabric and identity of a system. These have been termed **embedded dynamics** of change and reflect the ***natural*** and ***accidental*** dynamics which take place within a given system ***focus***. They can be natural in the sense that they are not consciously planned and controlled interventions into the normal established life cycle of a system. They can also be caused by accidental change types resulting from some external disturbance or unexpected internal failure/success. Embedded dynamics of change exist at deep levels within a system, operating across more than one hierarchical level, and affecting the eventual ***degree*** of change. They do have ***sources*** which initiate or reinforce them, and these can be explored using the various source categories discussed earlier (section 6.2).

Three theorists mentioned in earlier chapters have proposed similar concepts to the notion of embedded dynamics being advocated here. The first is Gersick (1991), who has developed the concept of **deep structure** in her exploration of the differences between evolutionary and revolutionary change within organisations. Acknowledging these she argues is essential to understanding the phenomenon of change, defining them as:

> "...a network of fundamental, interdependent 'choices,' of the basic configuration into which a system's units are organized, and the activities that maintain both this configuration and the system's resource exchange with the environment." (Gersick 1991: 15)

She examines six different knowledge domains (see Figure 3.5) to highlight examples, and argues that such structures, once well established, determine what changes are permissible within the organisation. These tend to be incremental and evolutionary in nature. For revolutionary change to occur, the deep structure must be altered and broken down, "...leaving the system temporarily disorganised..." (Gersick, 1991: 10). In time, new deep structures develop causing change behaviour to settle back into a more sedate, evolutionary pattern. Gersick's research suggests that deep structures represent fundamental drivers and controllers of change within organisations, which are largely implicit, unrecognised and often hidden. More significantly, they are the emergent, natural result of the complex interactions between the elements and relationships within the system.

The second is Morgan (1986) who advances the concept of **logics of change** (see section 2.5). The three logics he suggests - based upon concepts from autopoiesis, cybernetics and dialectics respectively - are primarily targeted at understanding change within social and organisational systems. He argues that they operate at a deep, micro level and underpin the reality of what we observe in everyday life. Like Gersick, he suggests that their origins are fundamentally natural - the emergent, synergistic result of internal tensions, contradictions, feedback loops and self organising processes within the system.

Thirdly, Wheatley (1992: 49) has taken the notion of **field** from the physical sciences: as in gravitational or magnetic field. This she abstracts metaphorically to a general level, defining fields as "...unseen structures, occupying space and becoming known to us through their effects". She goes on to apply the field concept direct to organisations, arguing that:

> "Organisational space can be filled with the invisible geometry of fields. Fields, being everywhere at once, can connect discrete and distant actions. Fields, because they can influence behaviour, can cohere and organise separate events." (Wheatley, 1992: 55)

Wheatley gives several examples of such fields within organisations, including corporate vision, culture, common values and ideals. These she believes, are capable of spreading out across an organisation, shaping and constraining changes that fall within their sphere of influence.

The concepts then, of deep structures, logics, and fields which are deeply enmeshed within the life and identity of a system, are all akin to the idea of embedded dynamics being proposed here. Drawing from the phenomena examined in Chapter 5, a number of other potential embedded dynamics of change are suggested here. These will now be discussed briefly. They are not exhaustive by any means. However they do demonstrate that it is possible to gain a deeper understanding of generic phenomena, if it they are studied *across* a range of disciplines. To maintain a richness of description and show the origins of each, the vocabulary of the original technical account are used as headings where possible.

6.9.1 Kinetic Energy (EDC 1)

System components taken in their entirety possess a restless energy which is a function of their individual *motions* relative to each other. Whether it be electrons in an orbit shell, atoms in a lattice structure, commercial organisations in a product market or share prices on a stock exchange, system elements can possess their own individual momentum with respect to each other that is continually shifting and changing. The effect within the system is to provide a constant background noise of micro level change. The net effect can be neutral for the system as a whole, if the fluctuations stay within broad parameters. On the other hand, the micro level shifts can be amplified and spontaneous self-organisation may occur as discussed in Chapter 5 (see ***dissipative structures*** in section 5.3.9) if certain *critical* tolerance limits are exceeded.

6.9.2 Potential Energy (EDC 2)

As with kinetic energy but this time the energy is latent and a function of relative *position* between system components. Examples of potential energy embedded change dynamics include hierarchy, rank, status and position within organisations and social groups. Often within group dynamics, individual behaviour is a function of who is present at the gathering and how influential they are perceived to be. This latent energy exerts a continual, subtle influence, changing behaviours from what they would otherwise be - all things being equal. It can be argued that what has been described as organisational politics (March, 1962; Pfeffer, 1981; Bower, 1983) is the result of this embedded dynamic of change.

6.9.3 Micro Level Competing Forces (EDC 3)

This embedded dynamic is based upon the process of chemical bonding: both ionic and covalent. The attraction and repulsion between elements of a system constitute a constant background noise of subtle, micro level change. Attraction and repulsion between system elements is based upon the existence of surpluses and deficits. This generates a natural competitive tension which can contribute to the strength of the system structure, its stability at a macro level and its propensity to change if subject to some environmental jolt.

For example, consider the formation of cross functional, multidisciplinary teams within traditional hierarchically based organisations. Line managers release resource from their own specialty areas for assignment to such a one-off project team, if they deem the exercise to be of long term benefit or politically expedient. If the project team falls behind schedule or fails to deliver, there is often pressure for the resource to be recalled. Organisations based upon matrix management structures attract and repel 'free floating' individuals with specific skills and expertise - who often find themselves pulled between two or more projects. Because matrix structures lack the unity and cohesiveness of command which traditional structures possess (Mintzberg, 1979), resource flow tends to be more fluid between functions and departments. Support, advisory and head office administrative functions can often find themselves the subject of competing calls upon their resource.

As with EDC 1 and EDC 2 above, the embedded dynamic of competing micro level forces represents a continual background source of deep level change against which larger transitions and transformation are played out - and sometimes spring from. All three EDC's are to a greater or lesser extent a function of structural tension within a system, and can provide the requisite variety (Ashby, 1956) at the micro level to allow creative and innovative behaviour to emerge.

6.9.4 Basins of Attraction and Repulsion (EDC 4)

Focal points of attraction and repulsion which draw system behaviour towards or away from certain states, constitute deeply embedded innate sources of change. It can be argued that internal entropy as defined by the Second Law of Thermodynamics, is one such point ***attractor*** - typified by the phenomenon of natural ageing and death. The tendency for chemical elements to become more stable as one moves across the groups of the Periodic Table is another. Within large multinational organisations, middle layers of management can act as an attractor towards stability and eventual stagnation. In their efforts to maintain the status quo, they can inhibit innovation, stifle creativity and dampen down second order change initiatives to first order where ever possible. Conflicting pulls for attention such as personal development and career advancement, versus loyalty and commitment to the company, parallel the phenomenon of an attractor - depending upon whether behaviour oscillates regularly between the two (periodic), or whether it is a complex pattern of behaviour which attempts to satisfy the attraction of both by existing at the boundary (chaotic). The conflicting pulls toward encouraging innovation and creativity on the one hand, and adopting a risk averse, defensive attitude to ensure the maintenance of a stable operating environment on the other hand, is another common tension which clearly needs to be kept in balance.

Conversely, organisations may be pushed away from point ***repellors*** such as buying behaviour which is not risk averse, or market penetration strategies that could have a negative effect on corporate image. What constitutes repellors (and indeed attractors) and where they are to be found within a given organisational space, will depend upon a number of factors, such as corporate culture, management style, and competitive environment.

6.9.5 Dissipative Structures (EDC 5)

This change dynamic produces counter-intuitive self-organising behaviour from a previously unstructured and disordered state, under the influence of some external source or environmental energy transfer. It can be deeply embedded within the system, drawing in and giving off energy to its immediate environment (see section 5.3.9). Although it requires an energy source to maintain itself, a dissipative structure can arise naturally or accidentally as an internal phenomenon, and its existence can have a significant impact upon the immediate surroundings. Zimmerman (1992) has suggested that organisations which undergo significant transformations in structure and output and yet retain a continuity of focus and identity, have processes at work within them which are akin to dissipative structures.

6.9.6 Metabolism (EDC 6)

This micro level embedded dynamic is responsible for the transformation of raw materials from the environment, into usable internal resource. It is essential in order to ensure:

- System viability and identity can be maintained within a given environment.
- The system has sufficient resources and energy to undergo change and adapt, in order to remain viable in a changing environment.

This is a natural, purposeful and continuous internal change dynamic and numerous organisational examples could be considered. For example, the process of converting raw materials from the supply chain into products, and products into eventual sales revenue is an essential metabolic transformation process for any commercial manufacturing company. Similarly, training and education for new employees to ensure they are capable of adding value and contributing to the productivity and profitability of the organisation is another key ongoing metabolic process. The conversion of raw data about competitor prices and products into a digestible intelligence report from which an appropriate marketing strategy can be derived, demonstrates the necessary conversion process of environmental data into usable internal information.

6.9.7 Boundary Contact (EDC 7)

As a system moves through the infinite possibility space that constitutes its environment, a change dynamic which is continually at work is interaction of the system with that environment. Clearly this may be selective and purposeful, but what is being considered here are the random and ***accidental*** encounters. Any given interaction or contact of a particular part of the boundary with a specific 'possibility' or part of the environment can potentially have change consequences for part or all of the system. It can likened to an ongoing friction, which produces minor first order change at the micro level for most of the time, similar to the background noise of change generated by EDC1, EDC2 and EDC3. However, occasionally it may result in major change. As earth travels through space, it encounters numerous minor meteorites from deep space which burn up harmlessly in the atmosphere. However, sometimes earth will encounter far larger objects which can cause significant changes within the planet's climatic and ecological systems. In organisational terms, these major disturbances may represent events such as privatisation, industry deregulation, hostile takeover bids or the advent of some new ground-breaking technology - all boundary contacts that have to be responded to reactively, or viewed as contingencies which must be anticipated and prepared for.

6.10 PRINCIPLES OF CHANGE

Drawing further from the change phenomenon investigated in the previous chapter, a number of **generic change principles** (GPC's) are proposed here. These attempt to capture recurring themes and common principles shaping change activity from a range of subject domains. As can be seen from Figure 6.1, they do not apply exclusively to the change foci discussed earlier, but can be seen at work within the ***sources, degree, resistance, level*** and ***outcome*** components of the framework as well.

6.10.1 Principle of Criticality (GPC 1)

Several of the change phenomenon examined in the last chapter had a life cycle of activity centred around a critical point or value. The build up to the change would involve ***permitting, predisposing*** or ***precipitating*** sources, up to the point where a key ***triggering*** event takes place. This has been observed by others as a common feature of change phenomena:

"In every domain, when anything exceeds a certain measurement, it suddenly changes its aspect, condition or nature... Critical points have been reached, rungs on the ladder, involving a change of state - jumps of all sort *in the course* of development." (de Chardin, 1961: 78)

In his discussion of synergetics Hanken (1983; 1981) explores the role of critical values in the process of change. He views them as the product of competing internal dynamics, created by specific combinations of parameters: "Because of internal fluctuations, the system tests different configurations or 'modes'. Competition between different kinds of such modes sets in, and eventually one or a few kinds of modes win over." (Hanken, 1981: 17)

Allen (1981) uses the term *critical parameter* to describe essentially the same thing. Upon reaching a certain value for such a parameter, a fundamental instability can be formed:

"This threshold marks the point at which the least fluctuation can cause the system to leave its uniform stationary state. When this occurs, a fluctuation is amplified and drives the system to some new state..." (Allen, 1981: 27)

Within organisational systems, this same principle has been seen at work: "...it seems that an initial key event or decision [ie: ***source*** category] causes an imbalance that either requires or facilitates a series of subsequent environmental, organisational, or strategy-making changes." (Miller and Friesen, 1980a: 271)

Phenomena discussed in Chapter 5 which demonstrate this principle include first and second order phase transitions; isothermal change; nuclear fission; and chemical reaction - specifically collision theory. The critical point acts as a defining constraint which determines the boundaries and operational limits of the system, providing it with a unique identity. Those boundaries cannot be crossed without the system *changing* in some manner. The behaviour of autocatalytic sets and the notion of 'critical mass' in nuclear fission illustrate that reaching the boundary and crossing it is a function of both the number of internal elements, and the level of feedback and interaction between them. These define some *threshold of complexity*. If the threshold is not reached, the system may be consigned to ***pejoristic*** internal changes and possible stagnation. On the other hand, reaching and crossing the threshold can result in variety, innovation and ***melioristic*** type change.

An obvious example concerns the human psychology involved in achieving some transition, found in most organisations: "...in any complex change process, there is a critical mass of individuals or groups whose active commitment is necessary to provide the energy for the change to occur." (Beckhard and Harris, 1987: 92). Similarly, simmering political and social unrest can be triggered into sudden public disorder at some critical point - usually caused by an event or decision taken at a local, micro level. Examples include the Bradford riots in the UK during 1994 caused by the death of a young person 'joy riding'; the Los Angeles riots sparked by the beating and arrest of a black citizen by white policemen; and the decision to strike by UK ambulance workers following the rejection of a Government pay offer - preceded by a perceived history of chronic under-funding, poor management and increasing patient demand. These critical points move the system from a state of uneasy equilibrium to one of instability and disequilibrium.

6.10.2 Principle of Least Resistance (GPC 2)

The phenomenon of crystalline fracture demonstrates the well known adage that nature will usually take the path of least resistance, whether it be lightning strikes, river flow or heat loss. Abstracted to a systems level, this principle suggests that change will be most likely to take place along paths where there is little to impede it, subject to the system's micro level structural configuration. Structural boundaries and clear lines of symmetry will define where change is most likely to occur with ease. Change phenomena which demonstrate this principle at work are often associated with ***sequential*** cause and effect chain events. This has important implications for ***planned*** change activity. Knowledge of the underlying system structure is essential if effective change measures are to be designed. Failure to identify system components where resistance to change will be weak may result in achieving a greater ***degree*** of change than desired. On the other hand, system change may be possible with far less resource and energy if key lines of weakness are exploited during change management.

For example, change in political systems can sometimes be best accomplished by basing the change measure around some existing structural feature, like an issue of common concern or a cultural norm. UK Government expenditure reductions in the area of defence in the early 1990's, and the subsequent reorganisation of the military organisations, was linked to the end of the Cold War and decreasing political tensions in East - West relations. Within commercial organisations, making some connection between a desired internal change which will be difficult to achieve, (such as management rationalisation; culture change; or business unit sell-offs) with some existing internal issue which is dominating corporate decision making (such as environmental awareness; health and safety concerns; or compliance with industry/Government regulations) can make implementation easier.

6.10.3 Principle of Induced Change (GPC 3)

Given a certain structural configuration and orientation towards the environment, a system can be susceptible to induced change from some external source - like the change of state caused within a metallic object in the presence of an electromagnetic field. For example, technological advances can induce structure and process changes within organisations, as certain tasks and functions become automated or obsolete, and production life cycles become shorter (See Hellreigal, Slocum and Woodman, 1986). New products released by competitors induce 'alignment' changes within an organisation's existing product range, so they can remain competitive, and keep up with best practice.

6.10.4 Principle of Metastability (GPC 4)

A metastable state will deteriorate over time, when the artificial conditions which keep it stable are disturbed, and it is forced to seek a lower equilibrium level by exploiting and diminishing local imbalances that have been created. For example, consider the implementation of a new computer system which replaces many manual and time consuming procedures. Soon after installation, staff may gradually begin to revert back to the old clerical procedures. Why? If insufficient training and support is provided prior to the transition, and the new computer system is not thoroughly tested, when the switch over occurs, the whole arrangement soon becomes untenable. It may remain metastable in the immediate short run, but staff disenchantment and frustration, software bugs and inappropriate functionality, plus the commercial pressure to get the job done all conspire to force the new regime to break down, allowing the old, stable operational practices to reassert themselves.

6.10.5 Principle of Environmental Coupling (GPC 5)

The concepts of autopoiesis and structural coupling suggest another fundamental change principle - some changes that a system undergoes following an interaction with the environment can be determined by its own internal structure, with the environment merely ***triggering*** a latent change dynamic. At an individual psychology level, we see specific failings and shortcomings in others if we ourselves have similar faults. In the words of Jesus Christ: "Why do you look at the speck of sawdust in your brother's eye and pay no attention to the plank in your own eye?" (Holy Bible, 1978: 961). This coupling clearly affects how we react to people and events outside of our domain of influence. In organisational terms, different firms within the same industry will respond differently to some environmental perturbation - for example the opening up of Eastern European markets following the demise of the USSR. Some will have seen it coming and made proactive changes to meet it. Some react to it when it happens. Doubtless a few will deem it of no immediate consequence to them, and do nothing in the short run. Each individual response will be a function of the organisation's world view, strategy and corresponding structure. Indeed, there may not even be agreement on *when* the environmental change took place, because of differing abilities to scan the environment, interpret events and report back internally to senior management. Differences in hierarchical layers, communication and control structures and senior management styles and agendas will all affect the change response made internally. On the other hand, it is not until an organisation interacts with the outside world, that it creates and shapes its own environment. Weick (1979) has called this *enactment*. Hence, the Eastern European market will only open up further and grow if firms enter it and invest, thereby making it a credible forum for trade.

6.10.6 Principle of Feedback (GPC6)

Feedback was noted as a recurring theme in Chapter 5, and is suggested here a generic principle of change. Relationships between two or more components of a system which contain a causal loop will engender a feedback process. Numerous writers have recognised the existence of feedback processes, particularly in the field of System Dynamics (see Sterman, 1994; Wolstenholm, 1990) where causal loops are explicitly modelled in an attempt to assess the impact of a change in one component upon the rest of the system. Soft operations research has recently begun to model organisational feedback processes and business work flows, with the advent of PC based business modelling software (see Ould, 1995; Pearman, 1995). Both positive and negative feedback processes are fundamental to many change phenomena. Positive feedback loops will amplify any input they receive causing a move away from the equilibrium reference state, whereas negative feedback loops will use the output to reduce the input, thereby causing a move towards stability. The latter Senge (1990) calls *balancing* feedback and describes how it is essential for goal oriented behaviour, as it acts to narrow the gap between the desired state and the actual state. As a driver and sustainer of change then, the notion of feedback is central to understanding change dynamics.

6.11 RESISTANCE TO CHANGE

That change is often resisted - particularly within social systems - is well known and well documented. History is replete with examples of resistance to change such as the introduction of street lighting; railways; electricity; cars; umbrellas and typewriters (Thomas, 1937; Barber, 1952). Greater exposure to change has certainly not decreased our resistance or made us less wary of it. As one commentator has observed, "Among many there is an uneasy mood - a suspicion that change is out of control." (Toffler, 1970: 27). Building upon the research of Beckard and Harris (1987), there would appear to be four broad responses to change within social systems:

(1) Prevent it from occurring (*intransigence*)
(2) Let it happen (*indifference*)
(3) Help it happen (*co-operation*)
(4) Make it happen (*execution/effectuation*)

Clearly, from a change management perspective they represent four points on a scale from little or no resistance at (4), to deliberate, active blocking of change at (1). Here, some general categories of resistance will be described, drawing once again from the change phenomena examined in Chapter 5. It is hoped they will provide some insight for change practitioners into different types of resistance. A better understanding of resistance to change will hopefully promote alternative ways of dealing with it effectively.

6.11.1 Nuclear Fission - Constructive Resistance

Within the core of a nuclear reactor, it is the resistance to change which produces the desired product - heat to produce steam. A natural chain reaction is initiated but contained within strict limits. It is this moderation or blockage which defines the nature, magnitude and direction of the change. Here resistance is actively sought as it essentially constructive - capable of achieving an ***outcome*** which can be planned for and anticipated. In organisational terms this equates to the generation of creative tension and apparent contradiction which in the short run generates resistance to change, particularly at the design phase of change methodologies (section 6.6). However, properly channelled and encouraged within a controlled environment, such resistance can be harnessed to generate innovative change ideas and commitment to eventual change implementation. The heat and frustration of the initial resentment towards change can be moderated and employed successfully. Approaches such as Interactive Management (Warfield, 1982; Warfield and Cardenas, 1993) and creative problem solving (Gronhaug and Kaufmann, 1988; Land, 1982; McCaskey, 1982) are good examples of ways in which resistance to change can be constructively and positively dealt with.

6.11.2 Isothermal Change - Absorptive Resistance

This type of resistance describes the ability of a system to remain unchanged in the short run, despite being subject to specific change ***sources***. It describes an ability to absorb the energy of change agents directed at it, and at the macro level at least, show no signs of change. In essence, absorptive resistance is equivalent to 'taking up the slack', acting as a buffer and insulating the system from change until certain tolerance levels are reached and critical thresholds are exceeded. Tightening procedures or legislation and increasing the amount of resources devoted to tackling a particular problem (eg: fraudulent unemployment benefit claims) will in the short run be unlikely to yield an significant improvements. But if the pressure for change is maintained long enough, or increased, something must give and behaviour will change. However, it may not be in the desired direction, and the problem could merely undergo a transformation and manifest itself in another guise at some other level of the system.

6.11.3 Self-Organised Criticality - Fragile Resistance

Resistance to change in some systems is very short lived and susceptible to complete breakdown by minor ***source*** disturbances. Fragile resistance is particularly applicable to large composite systems with many interacting elements - a precarious defence against external disturbances, with the system structure being particularly vulnerable. There is little or no absorptive ability within the system. Here the resistance is just sufficient to keep the system on the boundary between stability and change, again defining the operational limits and system identity. Fragile resistance represents a token defence before giving way to a transition towards a temporarily more stable state that is easier to maintain. For example, mutiny aboard a ship would typically begin with a dedicated few, but would soon spread as compliance and conformity to peer pressure was brought to bear by a growing majority. A similar dynamic can be seen in some industry pay disputes. There is an initial rejection of the first offer, but often resistance is shallow and weak. The implications and consequences of holding out for more wages are quickly considered as too costly, and the resistance collapses. Positive feedback processes and what Arthur (1994) has called *increasing returns* can be instrumental in hastening the collapse.

6.11.4 Adiabatic Change - Overload Resistance

Planned or ***natural*** change measures which seek to affect some change within the system by activating or accelerating internal feedback mechanisms and adaptive responses can fail because they overload the system. The absence of change can be perceived as deliberate resistance, but in fact may be no more malicious than a complete breakdown of the systems natural abilities to cope and adapt accordingly. Another result of overload resistance is to immunise the system against the desired change, by using an inappropriate ***source*** which is too intensive and causes more harm than good, rendering the system incapable of change along that line in the future.

6.11.5 Chemical Bonding - Bonded Resistance

System components will be joined together by relationships of varying intensity. A common link for many systems is the sharing of resources between components, tying them together. Planned change interventions which do not acknowledge pre-existent unifying relationships between two elements may not be very effective. Resistance to change on the part of the elements concerned can be quickly overcome, if the common bond between them is first identified and then 'dissolved' or weakened in some way. This can be done by providing a substitute to replace the commonality, which increases the element's propensity towards change. Alternatively, the introduction of a catalyst designed to diminish the strength of the resisting bond may be just as effective, altering the orientation of the elements away from the shared resource, thereby preparing them for the impending change. For example, bonded resistance within organisations could be reliance on old technology; union support; management style; or working procedures and regulations. Attempting to change mental models and mind sets would help break down some of the dependencies and make the desired change easier to achieve. Alternatively, the existing mind set could be used as a basis for introducing and selling the planned changes by presenting them in a way which is familiar and comfortable, using the language of the current paradigm.

6.11.6 Alkali Metals - Closed Resistance

As with the inherently stable Group VIII elements in the Periodic table, some systems may be so self contained and able to exert such tremendous influence over their constituent parts, that change ***sources*** from the outside have little or no impact. Typically, such systems will possess a highly co-ordinated command and control structure, limiting environmental exchange to an absolute minimum. Internal energy levels and background noise change (EDC 1,2 & 3) will be relatively low, with strong bonding between elements. Family run businesses are perhaps the best example of this type of resistance to change, demonstrating a reluctance to move with the times, preferring the time honoured traditions of their predecessors, whether it be whisky distilling, furniture manufacturing or car sales (see Beckford, 1992). Within a given industry, the vast majority eventually stagnate and go out of business. However, some will survive because their 'old and traditional' approach to producing the product - whatever it might be - acquires a desirable novelty value and they occupy a small niche in the market.

6.11.7 Autopoiesis - Newtonian Resistance

According to Newton's third law of motion, to every action there is an equal and opposite reaction. This category of resistance draws on the idea of survival and identity preservation that is at the heart of autopoiesis. When a change influence is brought to bear upon a system, it can react back reciprocally in an attempt to maintain its internal structure and homeostatic stability. Within social systems this can be manifest in the form of wilful opposition to a change, in an attempt to block anything new. Typically, the response from the change agent is to push back harder still, and enforce the change through some compulsory mandate - creating offence and ill feeling amongst those involved. Bednarz (1988), Goldstein (1988) and Hoffman (1981) have explored ideas similar to the notion of Newtonian 'push back' resistance being proposed here - specifically within organisations and social systems where autopoietic principles of self-preservation are at work. As a means of overcoming such resistance Goldstein (1988) suggests that the questions and mind set of those attempting to achieve change should be altered:

From: "Where do we need to add force to get this group changing?"
To: "How is the resistance to change a manifestation of the will to survive of this work group?"

From: "How is this resistance an impediment to our intentions?"
To: "How can this resistance be reframed to express its affirmative core?"

From: "How can we overcome the resistance?"
To: "What does the resistance tell us about the homeostatic 'settings' of this system?"

This requires asking 'Second Loop Learning' questions (Argyris and Schon, 1978) which seek to explore the nature of the resistance and work with it, as opposed to against it.

6.12 OUTCOME OF CHANGE

This part of the framework describes the condition or status of the change ***focus***, subsequent to the change. The inherent difficulty here is identifying at what point in time and space a given change activity finishes. However, if the framework has been used up to this point to describe and explain the change in question, it is hoped that the boundaries, operational parameters and characteristics of the change will have been defined to the extent that a distinct 'cut off' point can be specified or identified. Given this, the following outcome states are proposed:

Stable: Here, no further change of the same ***source, type*** or ***focus*** is deemed likely in the long term, all things being equal. The ***focus*** of the change will have reached a point of robust equilibrium - either *static* as in a motionless billiard ball, or *dynamic* as in Jupiter's Red Spot. Static equilibrium may result in system death if the system becomes closed to further ***source's*** of change (internal or external). Stable change outcomes may be the result of a point attractor ***embedded dynamic*** or merely the cessation of ***source*** input activity.

Metastable: This outcome state describes a condition of stability, but only in the immediate short term while certain local artificial conditions prevail (eg: super cooled/heated liquids). The stability is fragile and sensitive to minor disturbances, which could cause change activity to recommence. Metastable change outcomes are usually an intermediate stage; part of a series of change activities. The next stage - should the metastability be disturbed - is usually known or predictable. Metastable outcomes cannot be sustained indefinitely without the expenditure of considerable resource and energy, and will normally deteriorate down to a more stable state.

Unstable: Here, the result of a given change within a system leaves it with an inherent instability and propensity to change unpredictably in the future. It differs from metastable outcomes above in that there is <u>no</u> stability even in the very immediate term. Subsequent changes could be of any ***source, type*** or ***focus*** and occur at any ***level.*** There could be a strange attractor (EDC 3) at work within the system, not permitting it to settle in or move towards a state of equilibrium (dynamic or otherwise).

Catastrophic: This outcome category describes ***foci*** changes that result in the immediate and sudden death of the system. Following some process, structure or behaviour change for example, the system may be left in an unviable state, such that the identity and key activities of the system can no longer be maintained. The behaviour of an options trader within Barings Bank resulted in an ***evolutionary*** change in the corporate financial *state* of the bank during the period April 1992 to February 1995 - the outcome of which can be described as catastrophic. The bank lost its identity and ability to trade immediately the change in the corporate balance sheet came to light. (This particular example illustrates the importance of measurement in understanding the nature of change phenomenon. While the losses remained unmeasured due to ineffective back office, administrative and regulatory procedures, the change in corporate financial state was not perceived and therefore not acknowledged as real - ie: in ***nominalist*** terms. It could be argued that ontologically, the Bank became an unviable entity many months before it was actually declared bankrupt.)

An additional outcome category of **catalytic** was considered. This described outcomes where products resulting from the previous change act as catalysts, feeding back to perpetuate change activity at the same ***level*** and ***focus*** or other levels and foci of the system. However, it was felt that this was more a description of the propensity of a given outcome to initiate further change. The by-products and consequences of stable, metastable, unstable and catastrophic outcomes could each potentially act as ***sources*** for additional change within the system or its environment. It was therefore not pursued further.

6.13 SUMMARY AND CONCLUSIONS

The framework described in this chapter represents a very basic, initial conceptual scheme of some of the key components of change. It has been based upon a wide range of existing ideas, theories and definitions of change from across several disciplines, but is by no means comprehensive and all encompassing. However, as a systemic and recursive framework, it does pull a great deal of disparate thinking on change together into one analytical and descriptive tool. The reader is referred back Figure 6.1 which contains a diagrammatic summary of the whole framework.

It must be stressed that the framework has been developed from a limited number of change phenomena and descriptions. It is hoped that it demonstrates the power and utility of adopting a GST cross discipline style approach to phenomenon investigation, and that regardless of one's philosophical position, the framework can offer important insights into the nature and dynamics of change. Application of the framework to the target domain of organisational change is the subject of the next two chapters. Nonetheless, in keeping with the GST ideals of developing unifying principles and theories applicable across the sciences, it is anticipated that the concepts, issues and ideas embodied within the framework presented here will be of some benefit to change theorists in other subject domains.

CHAPTER 7

ORGANISATIONAL APPLICATION (I)

British Telecommunications plc Case Study

> *"Change stems from the imposition of the future on the present. Engines for the process are in conceptions of destinies and necessary steps toward their fulfilment."* (March, 1994: 40)

> *"The challenge facing modern managers is to become accomplished in the art of using metaphor to find new ways of seeing, understanding and shaping their actions."*
> (Morgan, 1993: 10)

7.1 INTRODUCTION

This chapter seeks to apply the change framework outlined in the previous chapter to a specific organisational change situation. It begins with a brief history of the organisation concerned (British Telecommunications plc) and then an overview of the case study scenario itself is given. Following this, the change framework is applied as a tool for describing and interpreting the changes that were observed. The method outlined in Chapter 3 for using metaphorical comparisons to explore an organisational change situation is also applied. The chapter finishes with some conclusions on the case study.

Once again, bold italics are used to highlight concepts that have already been introduced. Due to the sensitive nature of the changes being attempted within the British Telecom (BT), it should be noted that not all the specific details of the study can be documented here. Nonetheless, there is sufficient narrative to permit an adequate application of the change framework, and assess to what extent it is capable of describing and explaining actual organisational change phenomenon.

7.2 BACKGROUND AND BUSINESS SCENARIO

Since its privatisation in 1984, BT has undergone major structural change as it seeks to adapt to an increasingly deregulated telecommunications market. Staffing levels which once totalled 245,000 were reduced to 232,000 by 1990 and are now around 135,000 with a target of 100,000 by the end of the decade. The prevailing culture at the time of privatisation was aligned to basic monopoly service provision, not competition and sales. Major problem areas which the privatised company has had to deal with include severe demarcation in its engineering functions, over staffing and a corporate culture highly resistant to change.

In 1993, BT attempted to broaden its interests and traditional role as a domestic British utility company by forming an alliance with MCI - the second largest long distance phone company in America. Since then it has been exploring other potential joint ventures with major European telecommunications companies. With Mercury already competing for market share in the UK and AT&T due to enter the fray by the end of the year (Fagan, 1994), BT has been facing renewed pressure to rationalise its business yet further. In the UK alone there are already 98 other licensed operators competing for BT business. With technology in the industry advancing faster now than ever before, and new regulatory frameworks being imposed in Europe and America, BT can expect an even tougher next ten years of existence, than the previous ten.

7.3 THE CASE STUDY DESCRIBED

Since privatisation, BT has implemented a range of change management programmes to facilitate its transition into a global telecommunications player. These have included:

- 1986: Total Quality Management (significant culture change component)
- 1987: Strategic Systems Plan
- 1988-89: BT Business Model
- 1990-91: Project Sovereign and Process Management (Corporate restructuring with culture change implications)
- 1993-94: Breakout Project (Corporate wide Business Process Re-engineering exercise)
- 1994-95: Behaviour and Style Project

Throughout this period there has also been an on-going redundancy programme - 'Release 95' being the current. To state that the cumulative effect of these change management initiatives has had little impact on business performance would be unfair. As one commentator has noted:

> "Few companies have remade themselves so completely as BT plc, the state owned phone company that was privatised in 1984. Since privatisation it has cut costs, shed its slow moving bureaucratic methods and claimed a place as a dominant force in the worldwide telecommunications industry"
>
> (New York Times, 1993)

Indeed, figures for the period 1985 - 1993 demonstrate clearly that significant improvements have been made:

	1985	**1993**	%
Turnover (£m)	7,653	13,242	+73
Pre-tax profit (£m)	1,480	1,972*	+103
Headcount (000's)	235.2	167.9	-29
Quality (eg: fault cleared in 2 days)	87%	99%	+12

(Source: Beesley, 1995)

* Includes redundancy costs of £1,034m

Nonetheless, corporate downsizing and restructuring continues. This case study was concerned with the latest change programme - the Behaviour and Style Project, managed by the Employee Relations and Change Management Unit (ERCMU) which is part of Group Personnel. The ERCMU has historically performed an industrial psychology role within BT, with heavy reliance on statistical and psychometric methods. Part of their normal work involves conducting an annual company wide survey on Communications and Attitude Research for Employees (CARE). This takes the form of a questionnaire which attempts to capture employee views on a range of work related issues such as communications; training and development; relationship with management; and working conditions.

The aims of the Behaviour and Style project were threefold. Firstly, to obtain a detailed picture of the *current* culture within BT, targeting generic behavioural issues which CARE did not cover. Secondly, to assess what kind of culture employees *desired* to see in the future. And thirdly, to analyse the strategic direction and vision for the company being presented by senior management, to determine what future culture it *implied* and required. These three themes were captured in a rich picture (Checkland, 1972) developed by the ERCMU during the early stages of the project. This is shown in Figure 7.1. There has been deliberate avoidance of the term culture by the ERCMU in favour of the dual concepts *behaviour* and *style.* It is not the intention here to debate what constitutes culture as this has been done extensively elsewhere and there exists a substantial literature on the subject (see for example Kilman, 1985; Hofstede, 1991; Geertz, 1973; Schein, 1983; Kroeber and Kluckholn, 1952; Handy, 1981; Van Maanen and Barley, 1984) However, the concepts of behaviour and style as used by the ERCMU encompass all the usual aspects normally associated with organisational culture including norms; attitudes; beliefs; assumptions; feelings; values; and informal interactions etc.

Two specific outcomes being sought from the Behaviour and Style Project were:

- o In the short run, to feed the results into the ongoing Breakout (BPR) project to help ensure the implementation of business process and structure changes went as smoothly as possible.

- o In the long run, to develop an effective strategy for changing the internal behaviour and style of BT so it is better able to support future corporate strategy.

Like CARE, the Behaviour and Style project employed a questionnaire in attempting to assess current and desired culture within the organisation. However, unlike CARE, it was focused more on generic behavioural issues. The questionnaire design reflected the quantitative tradition of the ERCMU:

> "Each question asked respondents to identify their level of agreement with a statement defining behaviour both as they saw it within the company now, and

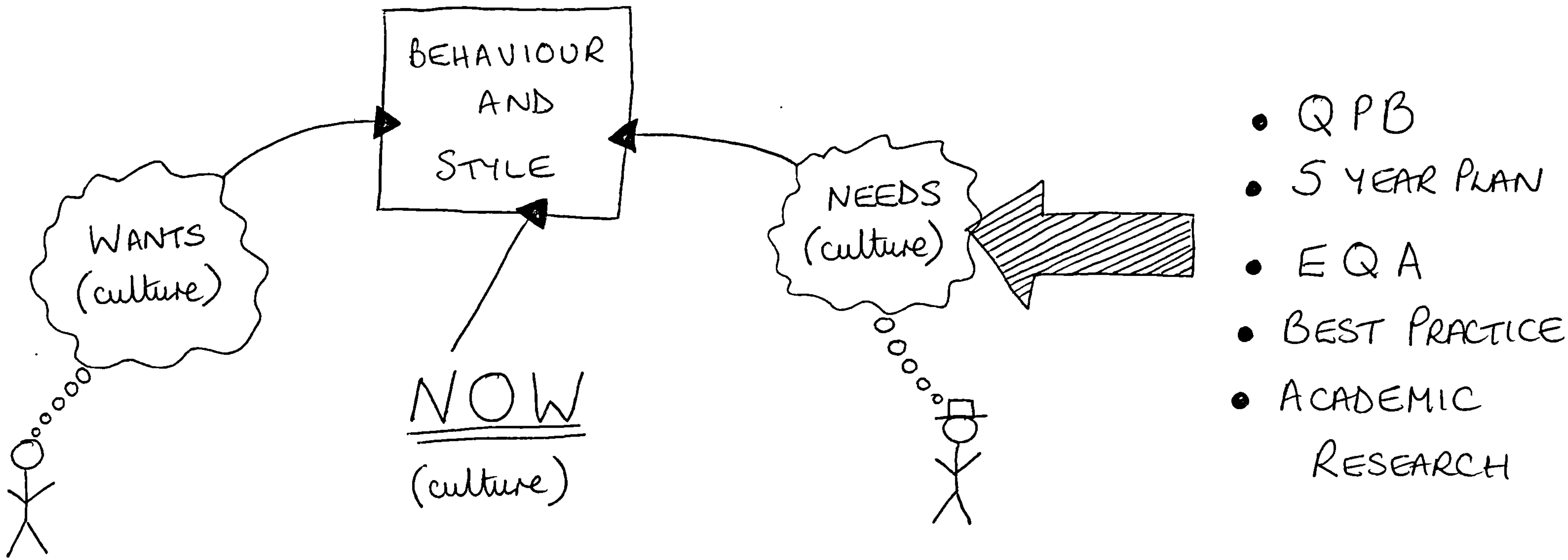


Figure 7.1: Behaviour & Style Rich Picture

as they thought it should be. Agreement was rated on a five point Likert scale as used in CARE from 'strongly disagree' to 'strongly agree'.
(BT internal document, 1994)

There was space given for individuals to write comments, providing a means of capturing qualitative and unstructured feedback. Employees selected to complete the questionnaire were chosen at random from across all functions of the company, but with particular concentration within certain work areas and grades. Participation in the project was both anonymous and voluntary. Of the 6454 questionnaires sent out, 2200 were completed and returned (approximately 34%). The raw data was processed by an external agency during the fourth quarter of 1994. The emerging picture from the exercise of the current organisational culture can be summed up under the following headings:

Control: The organisation has a regimented hierarchy, with a close management style and considerable regulatory pressure down through the various layers, resulting in very formal subordinate-manager relations.

Fear: Since privatisation, there has been a continual feeling of job insecurity and fear of redundancy as the organisation has undergone major change and restructuring. This has grown and is now deeply embedded within the culture.

Blame: There is a strong sense of 'blame attachment' based upon a common perception that mistakes are heavily penalised. As a result, there is a reluctance to acknowledge and take ownership of problems.

With a culture typified by control/fear/blame individual creativity and innovation is stifled, with employees unwilling to take the initiative, particularly while staff reductions are still being sought (Release 95) and the company is undergoing a major business process re-engineering exercise (Breakout).

The questionnaire results were used to assess what behaviour and style the company had currently, and what kind of behaviour and style employees desired to see.

Answers to the questions were grouped into ten areas deemed to be key behavioural dimensions that needed addressing:

- Achievement
- Adventure
- Challenge
- Customer
- Openness
- Political
- Quality
- Self Motivation
- Support
- Teamwork

The current position of the company with respect to these dimensions was determined from the questionnaire data. Then the future desired positioning of BT for the same ten dimensions was also decided upon, again drawing from the questionnaire data *plus* senior management statements and initiatives relating to corporate vision and strategy. Figure 7.2 illustrates these current and desired positions together, and shows the gaps which it was felt must be closed. These gaps represent specific changes in behaviour and style that were required.

Following senior management interpretation of the results, a number of action points were identified by the Board in February 1995. These are listed below:

1. Customer focus must be the unifying theme for teams.
2. A clear vision, list of goals and plan of action is required from a senior level.
3. A step change is required in management visibility.
4. All managers should be focusing on people motivation measures.
5. The relationship between employees and the company needs to be defined with greater clarity.
6. A movement away from control towards freedom of action on behalf of the customer is necessary.
7. A direct link between achievement and rewards must be established.
8. Team work needs to be more effective.

It was anticipated that taking steps to achieve these action points, would help close the behaviour and style gaps previously identified. During the Spring and Summer

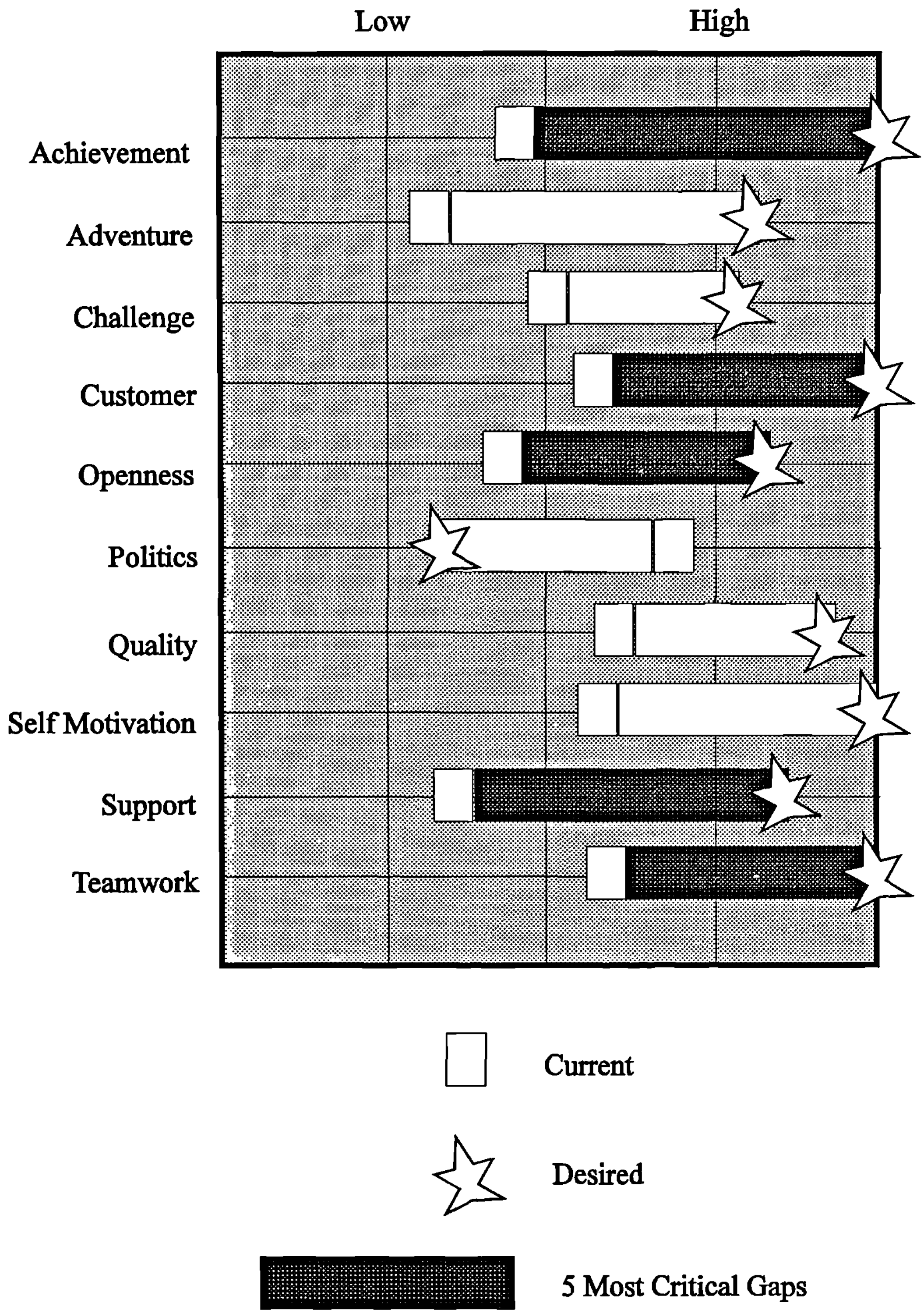


Figure 7.2: The 'Behaviour & Style' gaps to close
(adapted from BT internal documents, with permission)

of 1995, efforts were made to meet them, and these are on going at the time of writing. Two approaches were adopted. Firstly, there were attempts to infiltrate and influence existing company wide initiatives that were already in progress, raising some of the behaviour and style issues that had been identified where appropriate. Secondly, new initiatives were started which would focus on specific gaps and seek to address them. Appendix D gives examples of these for each of the action points listed above.

7.4 THE CHANGE FRAMEWORK APPLIED

As a starting point, three separate change ***foci*** were identified, which it was felt could be explained and better understood by analysing them using the change framework developed in Chapter 6. These were:

- **A.** The change in culture from current to desired being attempted via the Behaviour and Style project.
- **B.** The change dynamics and evolution of the current culture.
- **C.** The changes in organisational structure and process caused by the Breakout (business process re-engineering) project.

Unfortunately, the author was unable to obtain sufficient information to analyse satisfactorily C. above, and so only A. and B. will be explored here. They will now be analysed using the change framework outlined in Chapter 6. Reference to the framework summary in Figure 6.1 is recommended during the following discussion.

7.4.1 Focus A: Change in Organisational Behaviour and Style

The organisation had obtained an image of its current culture, along with a clear picture of what future culture it desired. The transition from one to the other had begun at the time of writing, but is still in its early stages, and so not all components of the framework will be applicable here.

The *focus* of the desired change is clearly that of ***behaviour***: the transformation was to be from one kind of culture, behaviour and style to another. Examples of some of the transformations being sought include:

- o Conservative, risk avoidance behaviour *TO* innovative, risk taking behaviour
- o Autocratic, disciplinarian management style *TO* open management style with decision making pushed downwards
- o Slow action; approval seeking *TO* quicker action; taking the initiative

It could be argued that seeking these desired transformations represents an earlier change in ***strategy*** by senior management, which in the long run will affect the overall ***state*** of the organisation. However, analysis of strategy was not possible during the study, and measurement of final state is beyond the time scale of this thesis. The strategic changes implied here were therefore not studied in detail during the course of this case study.

The ***source*** categories identified and seen at work were:

Information: **1.** - Data from the 1992 to 1994 CARE questionnaires. (***Predisposing***)
2. - Informal feedback from management. (***Predisposing***)
3. - Results from the Behaviour and Style questionnaire (***Precipitating***)

Process: **4.** - The on-going restructuring and downsizing programmes. (***Predisposing***)
5. - Growing senior management awareness that a change in corporate culture was required (***Permitting***)

Action: **6.** - Senior management decision to assess the culture within BT. (***Permitting***)
7. - Infiltration of existing corporate wide initiatives and commencement of new ones, aimed at closing the behaviour and style gaps identified (***Triggering/Reinforcing***)

It will be noticed that some of the above sources are significantly longer lead than others - for example 5 and 6 - and yet are nonetheless absolutely essential if the culture change is to occur at all. There are clearly other more indirect and external factors which individually could be deemed a ***source*** of one sort or another, including for example: firms entering the telecommunications market and adding to the competitive pressures; pressure from trade unions; and Government legislation to deregulate the telecommunications industry in the UK. These could all be described as ***predisposing*** factors which combined to cause senior management to examine the performance and effectiveness of BT's human resources. However, they are considered here to be not of direct influence. Nonetheless, they are still worth documenting as hindsight and subsequent implementation difficulties may show them to have been of greater significance than first thought.

In terms of ***type***, the change can described as ***planned***. That is, senior management have determined deliberately to move the culture of the organisation from its current state through a series of premeditated actions in accordance with a set of corporate objectives. These are summed up in the senior management vision statement quoted in Appendix E - created after the Behaviour & Style questionnaire results were known. Changes in behaviour and style were seen as necessary to improve the overall performance and efficiency of the organisation. In this sense they can be described as ***melioristic***. On the other hand, the change was designed to shift the culture to a more open, flexible, innovative and less control orientated way of working. This can be perceived as ***pejoristic*** because the benefits resulting from corporate changes in behaviour and style, are traded off against a loss in structural cohesiveness and central control. Following Stacey's (1993) line of reasoning discussed in Chapter 6, the latter can be interpreted as an attempt to push the organisation away from ossifying stability towards creative disequilibrium, in anticipation of achieving a better balance between these two attractors. Whether the push has been hard enough, only history will show.

Due to the planned nature of this change situation, none of the ***embedded dynamics*** discussed in Chapter 6 are relevant here, as the change was to be realised through ***methodology*** and premeditated intervention. However, that is not to say that none of the background noise change dynamics of EDC's 1, 2 or 3 were at work (see section 6.9), but they were not specifically focused on during the study.

The ***attributes*** and characteristics of the behaviour change are difficult to assess at the time of writing, as the project is in its early stages. In terms of the ***random - deterministic*** dimension, the general direction and thrust of the change could be described as deterministic. At a macro level, triggering and reinforcing sources can be identified; key behavioural change objectives have been set; and movement has begun towards meeting those objectives through a series of sporadic planned change activities. Within certain broad confidence limits, the ERCMU can predict how well the various organisational groupings within BT will respond to the change initiative. However, at a micro level, the day to day impact of the change programme upon specific individuals is entirely unpredictable. Who will attend the workshops and initiatives designed to communicate and engender the desired changes, and how specific employees will react is inherently unknowable. Corridor encounters, sickness, chance conversations, individual mood, character and length of service are just a few of a multitude of variables which will determine whether a given BT employee will hear of the new behaviour and style being advocated, take it to heart and change his/her values, attitudes and behaviour accordingly. So in this sense, the change can also be described as random. This uncertainty at the individual level is similar to quantum indeterminacy - prediction is only possible based upon approximate probabilities concerning large organisational groupings of employees. Compounding this uncertainty is the fact that the implications of Behaviour and Style are of a soft, intangible and qualitative nature. As a result, the ERCMU have acknowledged that they are finding it difficult to define what the results mean at an individual level, and communicate them effectively across the organisation as a whole - without generalising.

On the ***sequential - parallel*** dimension, change is likely to be of a parallel nature. This is because ten key behavioural areas are being targeted (see earlier list in section 7.3). As an arbitrary and unconnected example, initiatives to increase self-motivation are bound to have an impact upon the Quality, Adventure and Customer dimensions at least. Likewise, increases in support will have immediate affect on Teamwork, Politics, and Openness, and in the long run, impact upon many of the other targeted behaviours. Their interconnected nature makes parallel change an inevitability. Figure 7.3 shows a causal matrix prepared by the ERCMU in an attempt to explore the interdependence and change dynamics of these behavioral areas, *prior* to the changes being actively sought.

Significant, large scale change in organisational culture takes a long time to occur - sometimes several years - as Browne, Vancil and Sathe (1982) have shown. An established culture is not easily transformed as demonstrated by the numerous accounts of failed culture change (see Kilman, 1985). Culture changes that are achieved therefore tend to occur spasmodically following some internal planned change programme as with BT (eg: TQM 1986; Project Sovereign 1990; Behaviour and Style 1994) or following some major environmental disturbance such as a takeover or merger between two organisations, where the two different cultures are forced and mixed together. On this basis, the anticipated corporate behaviour changes at BT can be described as discontinuous. However, the environmental context within which BT operates is undergoing significant continuous transformation with increasing competition and technological change. The discontinuous and planned internal behaviour change then, can be interpreted as periodic adjustments and realignments with a continuously changing environment (akin to the Group VIII - Group I chemical element energy level transformation discussed in Chapter 5.)

Nonetheless, at the micro level of individual employees, values, attitudes, norms and expectations are being shaped and moulded continuously. This can be likened to the background change noise generated by EDC1, EDC2 and EDC 3 discussed in Chapter 6, which is qualitatively different in scale and magnitude to the main behavioural change ***focus***.

On the ***reversible - irreversible*** dimension, at a macro level behaviour and style change within BT can be considered reversible. Short run changes in human behaviour can be reversed as psychology research has demonstrated (Miller, 1980; Milby, 1981; Gossop, 1989). However, the longer the new behaviour is maintained with ***reinforcing*** sources, the more likely it is to become irreversible and deeply

Causal Matrix - Idealised

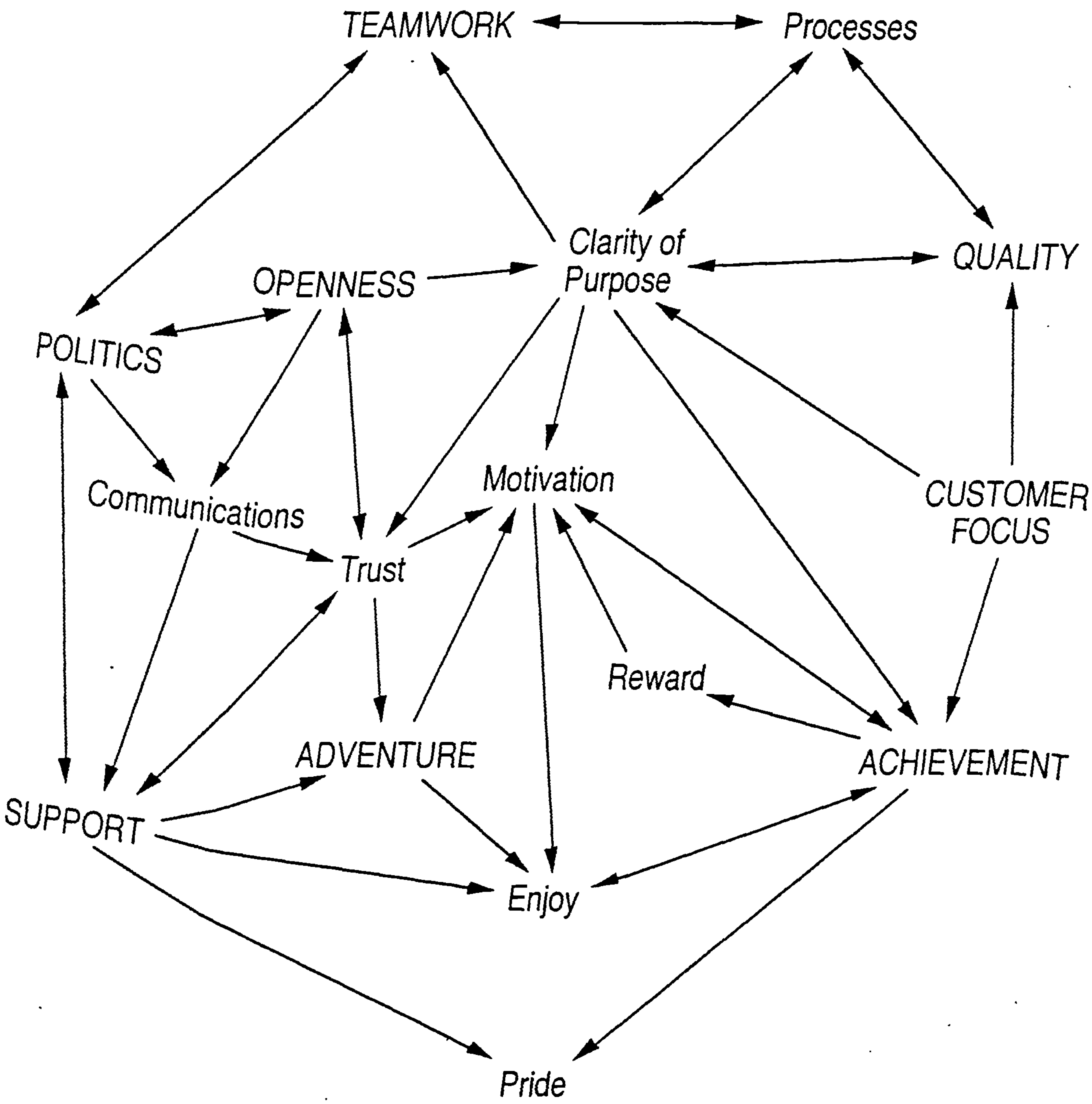


Figure 7.3: *Causal Matrix of Key Behavioural Dimensions*
(From BT internal document - used with permission)

rooted into the corporate identity of the organisation. Reversibility will be discussed again in connection with ***outcome*** later in the chapter.

There are two structural ***levels*** at which behaviour change is being sought. The first is at the micro level of the individual employee and their own behaviour and style. It is anticipated that during and subsequent to change at this level, there will be a second change at a corporate level as individual behaviour change manifests itself as culture change at the level of the whole organisation. Certainly, ***measurement*** has been undertaken at the correct ***scale*** prior to the change being initiated, with the questionnaires being sent to individual employees. However, in planning for the desired culture change, the ERCMU is in danger of missing key micro level dynamics by using hard statistical aggregates taken from the questionnaire data to form a general picture of current and desired culture. The analysis and design of effective change agents to move the culture from current to future could suffer from the pitfalls described by Pearce (1994) and Hayek (1988) as discussed in Chapter 6.

There was no explicit ***methodology*** being followed by the ERCMU during the Behaviour and Style project, although parts of Simon's (1960) four key phases can be identified.

Intelligence activities included:

- Reviewing the academic literature for appropriate culture change models
- Discussions with external management consultants
- Analysing existing internal data (eg: previous CARE surveys)
- Gathering specific data on behaviour and style via a questionnaire
- Analysis and validation of the questionnaire results

Design and ***Choice*** activities included:

- Reporting the results to various management groups for interpretation and discussion
- Identifying the key gaps between current and desired behaviour which needed addressing
- Drawing up an action plan to change behaviour and style in the required areas

- o Designing new initiates which could help achieve the behavioural changes required
- o Identifying existing corporate wide initiates which could be used as vehicles for implementation

Implementation activities include (to date):

- o Commencing new initiatives chosen earlier (see Appendix D)
- o Infiltrating existing programmes and initiatives chosen earlier
- o Using subsequent CARE surveys to monitor and feedback the progress and effectiveness of the change agents selected.

Overall, the approach taken can be described as ***ideographic*** in that it was pluralist and did not force a unitary cultural solution upon the organisation. However, some of the statistical methods and measurement tools employed were reminiscent of more ***nomothetic*** approaches.

As the implementation measures have just begun at the time of writing, only the anticipated final ***outcome*** can discussed here. Certainly, there is a desire to see a ***stable*** outcome following the completion of the Behaviour and Style project. That is, a new culture which persists over time and does not continue to change in the same direction beyond the desired limits prescribed by the ERCMU and senior management. Whether such a desired outcome is achievable is debatable - given the dynamic and turbulent environment within which BT operates and the ongoing internal downsizing programmes.

It is possible that the change in behaviour and style may overshoot the set targets. For example, the rating on the Adventure dimension could move higher than desired in the longer term, resulting in high risk decision making at both an operational and policy making level. Similarly, the Support dimension could move to levels where employees feel smothered, and accountability becomes shared to the point where potentially, nobody is actively taking responsibility. If the proposed new behaviour and style is received enthusiastically by employees, stopping the change once the project objectives have been met may prove difficult (British Airways encountered this problem during a cabin crew culture change initiative in the late 1980's). To date, the ERCMU have not planned for possible overshoot, thought through the likelihood and consequences of it, or considered possible 'breaking' mechanisms should the initiated change continue unabated.

While the above scenario is a possibility, a ***metastable*** outcome is more likely. Here, the triggering and reinforcing sources discussed earlier could provide enough momentum for the 'behaviour gaps' to eventually close and a new way of working instilled in the work force. However, because accommodating procedural and structural changes are not being planned and implemented at the *same time* to provide a more conducive environment within which the new behaviour can flourish, the change may degenerate and the old culture reassert itself. The new behaviour and style may then be expected to survive within the old environment - ie: structures and processes which have the old ideals, norms attitudes and values built into them. It is the author's view that unless these are dismantled and changed themselves, any behaviour and style changes achieved will be short lived. Reversion back to the old culture is likely to reinforce and embed it deeper into the cultural fabric of the organisation, making future behaviour change even harder to achieve. The ERCMU are aware of this possible outcome, and are trying to establish links with internal BT policy makers, to ensure future infrastructure changes reinforce the new desired behaviour and not the current/old culture profile.

The ***degree*** of change desired is clearly that of ***second order*** - a significant shift in corporate values and cultural identity. However, human behaviour change at the level of norms, attitudes and values takes time and usually occurs in an incremental manner. Therefore, if the change is successful, it is likely to take place in a slow evolutionary way over a long period of time - but the end result will be a radical change from the original cultural identity of the company. Another issue here relates to how the ERCMU intends to measure and assess to what extent the desired behaviour changes has been achieved. The intention is to use future modified CARE surveys (twice annually) to test for movement in the ten key behavioural dimensions listed earlier, along with Viewpoint Focus groups to assess deeper employee responses and values to the Behaviour and Style initiative. However, questionnaires and focus groups can only really capture attitudes, values and expectations. Assessing whether the change in attitudes and values is being manifested in actual corresponding behaviour change is inherently difficult (Sathe, 1985). At the time of writing, the ERCMU appear to have no specific remit or measurement tools to determine the degree of any future behaviour changes.

Three potential types of ***resistance*** are likely to be encountered as the Behaviour and Style Project continues. ***Absorptive*** resistance is likely to be the first barrier to changing the current control-fear-blame culture. Initiatives to reshape it will be viewed with suspicion in the short run. The changes in ideals, norms and attitudes will take time to sink into the collective corporate consciousness. During this orientation phase, few obvious and discernible results will be evident, as employees come to terms with the behaviour changes being asked of them. Considerable BT resource and energy may be required to achieve the necessary 'activation energy' to ensure the changes even begin.

Another type of resistance that may be encountered is ***bonded*** resistance, caused by the hierarchical control orientated structure of BT. Like the lattice framework of a crystal which gives it strength and stability, the type of structure BT employ to organise and co-ordinate its resources, maintains and gives shape to the current cultural identity and behavioural profile. As with bonds and lattice formations in chemicals, the existing hierarchical command and control structure within BT will need to be 'weakened' and reorganised into a more open, innovative structure. This will enable the move towards the desired behaviour and style to occur more smoothly, and facilitate the transition to the desired corporate cultural identity. Perhaps of more importance, such a reorganisation will help reinforce and support the desired behaviour and style once it has been adopted. However, as discussed earlier if these structural bonds are not weakened a ***metastable*** outcome may result. When discussing the metaphor of bonded resistance with ERCMU management, they commented that because of the vast size of BT, the structural bonds were not always stable across the whole organisation. Nonetheless, it was agreed that the cultural norms which underpinned the corporate command and control structure were deeply embedded and had survived, despite repeated changes to the organisation charts.

A third type of resistance to change already in evidence within parts of BT is ***overload*** resistance (section 6.12.4). As a result of the history of intensive change initiatives within the company, many employees have become cynical and hardened to 'change', and are naturally wary and suspicious of what they see as 'just another change programme'. The trauma of voluntary redundancy schemes, corporate restructuring, downsizing and new technology implementation has created an immunised mind set in certain quarters which is resistant to yet further change - however intrinsically well intentioned it appears to be. The rhetoric and vision statements from senior management have been heard perhaps once too often for some, and full cooperation in change initiatives may never be obtainable from them. The 'elastic' of their goodwill and willingness to participate has been overtaxed and stretched beyond its elastic limit, and is now incapable of recovering its former flexibility.

7.4.2 Focus B: The Change Dynamics of the Current Culture

Here, the dynamics and emergence of the current culture will be explored using the change framework. It became evident from discussions with various BT staff both inside and outside the ERCMU, that the existing culture of control-fear-blame had been in evidence prior to privatisation. Since then, it has been developing and growing stronger, and its emergence represents a ***natural*** change ***type***. The BT culture has been created and nurtured over many years. Its current state has been influenced by a number of factors including: a political and more recently competitive external environment; an autocratic leadership and management style; a bureaucratic and hierarchical organisation structure. It has evolved in response to the organisation's turbulent life cycle, reflecting the pressures, uncertainty and strains that both senior management and the environment have brought to bear since denationalization in 1984.

The Behaviour & Style project has merely acted as a ***reinforcing*** source, augmenting the evolution of the current culture and driving it deeper into the fabric of the organisation. The use of postal surveys as a measurement technique can seem remote and detached from the operational realities and problems faced by employees. For some, it may be seen as 'just another attempt to control and manipulate'. Other

source categories which have fed the evolution of the current culture over the years include:

Information: **1.** - In addition to formal announcements regarding staff reductions and business rationalisation, speculation and rumour about impending redundancies and restructuring can act as a pernicious form of information, fuelling emotions of fear and insecurity throughout BT. (***reinforcing***)

Action: **2.** - The Behaviour and Style survey as a form of intervention to diagnose current culture could have sent inappropriate signals to employees: an example of measurement driving ***pejoristic*** behaviour change. Disgruntled individuals may have interpreted it as another attempt to obtain information which can be used to 'control' them and determine their future. Put into context, the questionnaire was distributed while staff redundancies were being sought (Release 94 and 95) *and* while the organisation was undergoing major structural change following the Breakout initiative. (***reinforcing***).

Process: **3.** - For a company with a risk averse culture, the new markets opening up within the telecommunications industry as technology advances - such as multi-media and cable - have bred uncertainty and concern about the future. (***reinforcing***).

4. - Interventions and measurement activities not associated with normal core business activity, such as the ongoing process of corporate change programmes and restructuring exercises over the past fifteen years. (***reinforcing***)

5. - The continual reduction in staffing levels since 1984 from 245,000 to 135,000 as of September 1995. (***reinforcing***)

6. - The increasing deregulation of the telecommunications industry makes for an unpredictable future. Uncertainty and fear of the unknown constitutes a powerful catalyst for perpetuating the existing culture. (***reinforcing***)

These reinforcing ***sources*** have acted to perpetuate the existing culture, forcing the values, attitudes and norms deep into employee consciousness and causing 'behaviour and style' to evolve into more pronounced manifestations of the control-fear-blame mentality.

Since privatisation, the ***degree*** of culture change is clearly evolutionary, slow and of first order proportions, with small incremental shifts in behaviour which move the culture towards a more closed, unmotivated and insecure disposition. In terms of attributes, this change can be seen as largely ***deterministic*** and ***sequential*** - an inevitable and predictable result of the various ***source*** inputs and internal interactions within the organisation. The causal matrix shown in Figure 7.3 illustrates some of the cause-effect relationships which have shaped and nurtured the emergence of the existing culture. Results from previous CARE surveys over the years would suggest that the birth and evolution of the current culture has been fairly ***continuous***, with no dramatic step change shifts in behaviour. Nonetheless, the ERCMU clearly believe this development to be ***reversible***, but only history will reveal whether they are right.

In terms of ***embedded dynamics***, the evolution and maintenance of the existing culture within BT can be likened to that of a ***dissipative structure***. Given time, it can be argued that if the current culture was left undisturbed and the ***reinforcing*** source inputs abated, the existing culture would erode somewhat. A residual control-fear-blame mentality would remain, but only at some nominal level - maintained by the prevailing hierarchical structures within the organisation. A degree of internal entropy would begin to emerge. However, while the current culture is connected to some energy force, such as the Breakout restructuring initiative and the Release redundancy programme, it will self organise into an even tighter control-fear-blame culture with self-reinforcing feedback loops being set up (***GPC6***). The effect of this embedded dynamic is to institutionalise the existing behaviour patterns and responses. As long as the 'nervous energy' being supplied by the corporate convulsions of restructuring is maintained, it will perpetuate itself. With respect to ***levels***, the ***scale*** across which this dissipative structure of culture manifests itself is of interest here. As with dissipative structures in the natural sciences, it is the fluctuations at the micro level - in this case the behaviour of individual employees - which combine to produce a macro level phenomenon: namely a corporate culture and identity typified by the characteristics of control-fear-blame.

Resistance to the creeping, incremental transition towards this culture has been difficult to detect. The innovative, creative and free thinking employees who would be most likely to offer serious resistance to the emerging culture have mostly left under the voluntary redundancy scheme. This leaves an organisation replete with employees content with the status quo, not seeking conflict. With few dissenting voices, the current culture has been able to evolve unchallenged and unimpeded. To use the evaporation metaphor, the 'impurities' (ie: creative, flexible individuals who did not fit) have been boiled off leaving a residue of like minded individuals with a similar behaviour and style profile.

One possible ***outcome*** of this culture evolution is ***stability***. That is, with the ***reinforcing*** input sources described earlier able to keep it in dynamic equilibrium, the dissipative structure EDC could remain indefinitely. Conversely, should the major restructuring and down-sizing initiatives stop, there is a case for saying that the impetus for the control-fear-blame mentality will abate somewhat. However, an alternative view is that even the cessation of major internal reorganisations and redundancies will not be sufficient to dislodge the existing culture from its current state. It is held firmly in place by such things as existing command and control structures, performance measurement regimes, reliance on contract staff, and demarcation strategies - all of which continue to provide it with the justification and support that it needs. This alternative view suggests that like Jupiter's persistent Red Spot, the existing BT culture is far more stable and symbioticlly linked to its immediate internal environment than senior management realise.

7.5 METAPHOR APPLICATION

During the course of the study, several metaphors and analogies were used to describe the current internal reorganisation and impending cultural change. Some of these were generated by BT staff during interviews and discussions. Others came from the author. One of these will now be described using the metaphor operationalisation procedure outlined in Chapter 3 (summarised again here for convenience):

Step 1: Generate an initial change insight between some phenomenon within natural or physical sciences, and the organisational situation under investigation.

Step 2: Generate a conceptual model for both the phenomenon and the organisational situation, in order to explore the metaphor in more detail.

Step 3: Undertake an isomorphic mapping between the two models.

Step 4: Draw out any implications for the organisational situation.

7.5.1 Geology Metaphor

Step 1: BT as an organisation is like the geologically active layers that form the earth's surface, because of the following broad similarities:

- To the external observer, both appear solid, stable and permanent.
- Both are subject to powerful forces and dynamics of change internally.
- Occasionally, these forces become visible to the external observer when they cannot be contained, and are manifested in a variety of ways at the 'surface'.

Step 2: Geological Model

On the surface, the earth appears in equilibrium. Yet underneath are powerful subterranean forces and change dynamics in constant motion and turmoil. Periodically, these break through the surface and become visible to the observer. Figure 7.4 illustrates a basic model of the earth's surface composed of the atmosphere, the hydrosphere and the lithosphere. As can be seen, the lithosphere is composed of three layers: the crust, the mantle and the core. Where the surface rocks are porous, weak or not very thick, hot fluids present within the mantel and the core can break through and move up to the surface. Such geothermal activity can take a variety of forms including volcanoes, hot springs, geysers and fumaroles, the results of which can affect the lithosphere itself as well as the hydrosphere and atmosphere. Structural shifts caused by fracturing or sudden movement within the lithosphere (earthquakes) can result in widespread shocks and damage at the surface of the lithosphere and within the hydrosphere. Earthquakes occur following the gradual build up of stresses between parts of the earths crust and mantel, which reach the point of fracture or

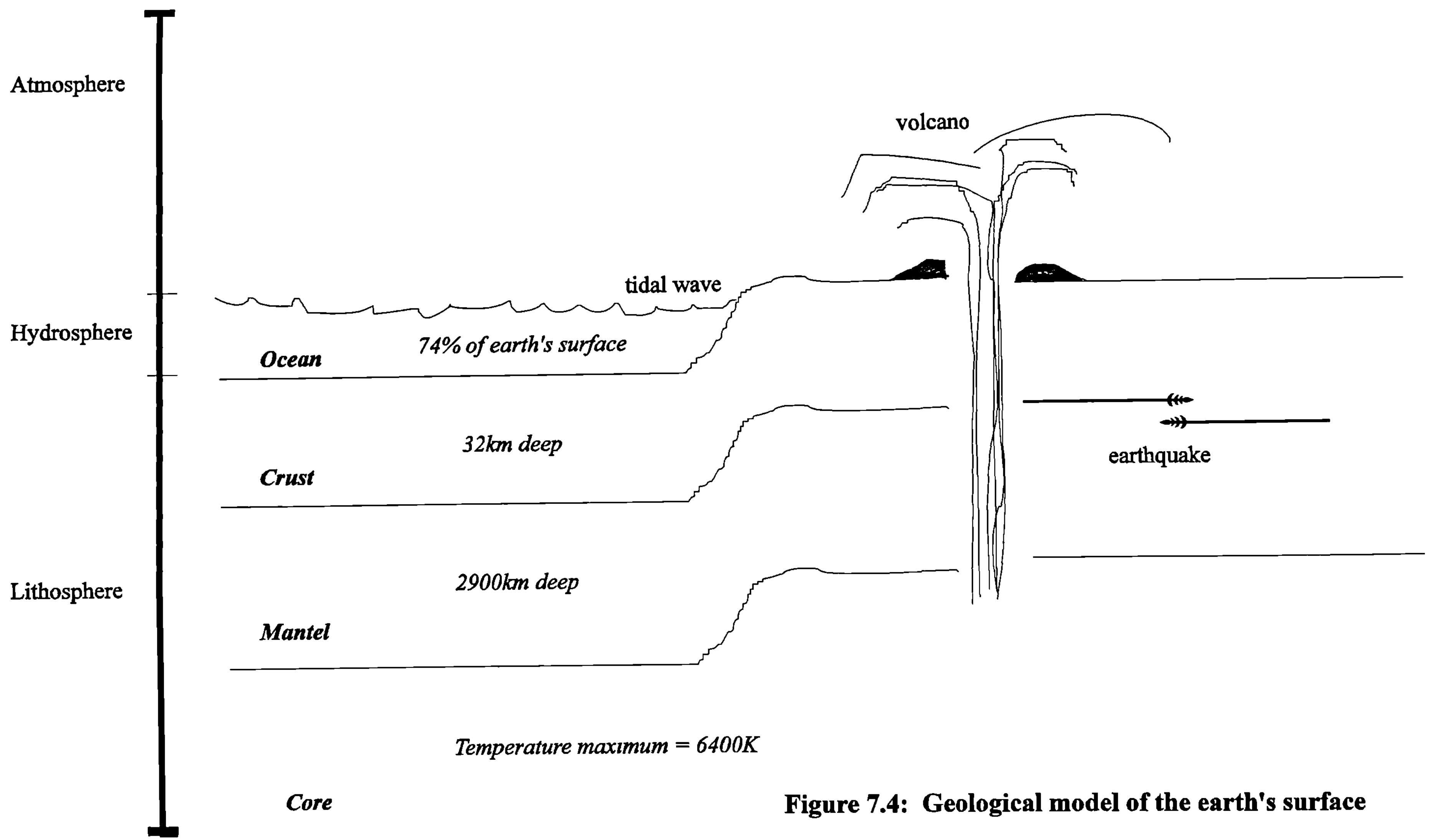


Figure 7.4: Geological model of the earth's surface

shearing. They are mainly confined to specific locations and belts of activity on the lithosphere around the surface of the planet.

Organisational Model:

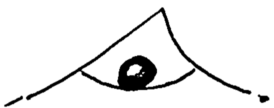
Figure 7.5 shows a conceptual model which describes the internal dynamics of BT at present. The organisation can be said to consist of several notional layers of which most external observers only see one or two: namely Customer Service and Financial Position. The levels identified are ordered according to their respective degrees of exposure to and consideration by the non-BT general public. To a lesser extent, the hierarchical layering also attempts to capture the order in which one layer will impact upon another, if there was to be a significant change at the deepest level (Cultural Profile). More informed external individuals will 'see' to deeper levels (eg: journalists; City analysts, researchers and management consultants). Each level has dynamics of its own and will interact with other levels.

Step 3:

Figure 7.6 shows a direct mapping of one model to the other, highlighting similarities.

Step 4: There are several implications, insights and ideas for BT management, that can be drawn out from this mapping exercise:

- Internal change dynamics of whatever *type*, can possess far more power - destructive and creative - than most managers and change practitioners anticipate.
- It is possible to conceal the turmoil, stresses and strains of planned internal change initiatives and natural organisational life cycle dynamics for most of the time, from detection by external observers. In the interests of share price value, public image, corporate identity, investor confidence and customer satisfaction, this may be a desirable policy.
- The internal friction, energy and momentum created by planned change initiatives and life cycle dynamics must be dissipated or placated by the organisation somehow, to ensure a stable and 'attractive' image is presented to external observers - thereby encouraging growth, confidence, and customer satisfaction.



Perception by
external
observer

Depth of level: ***surface***

1. CUSTOMER SERVICE	*BT Shop; Telephone engineers; TV & media adverts; Network reliability...*
2. FINANCIAL POSITION	*Share price; Share dividend; Quarterly figures; Annual statement; Financial press reporting....*
3. STRUCTURAL COMPOSITION	*Organisation structure; Corporate ownership profile; Joint ventures; Communication & control structure; Geographic structure.....*
4. PROCESS FLOW	*Core & Support business processes; Roles & responsibilities.....*
5. BEHAVIOURAL PROFILE	*Range of modes and types of response; Behaviour patterns; Training; Experience.....*
6. CULTURAL PROFILE	*Attitudes; Norms; Expectations; Values; Ethics; Mission statement.....*

deepest

Figure 7.5: Conceptual model of the BT organisation showing depth of perception 'layers'.

Geological Situation	**British Telecom Parallel**
Lithosphere	BT corporation
Atmosphere and hydrosphere	BT external environment /market place
Subterranean lithosphere dynamics	Change ***types***: - natural, planned and accidental - within BT
Subterranean molten larva flows, minor tectonic plate movement, rock compression etc.	Background noise change of ***embedded dynamics*** - EDCs 1, 2 and 3.
Eruptions at the surface (minor) - geysers, steam, ash etc.	Release of internally generated information such as customer surveys, new product/service details, changes in management or office location etc.
Eruptions at the surface (major) - volcanic blast, pyroclastic gas emissions, molten rock and boiling mud.	Release of internally generated information such as large scale redundancies, bad quarterly financial results, or the leaking of sensitive reports etc.
Volcanic ash and debris spewed into the atmosphere (cf: Mount Pinatubo) Tidal waves caused by earthquake epi-centres beneath the hydrosphere.	Affect upon external actors and stakeholders in the environment. Eg. customers, competitors, shareholders, Government regulators.
Major earthquakes caused by periodic tectonic plate movement.	Major structural change within BT caused by internal corporate reorganisations, joint ventures (eg: MCI), take up of new technology etc.

Figure 7.6: Comparison between geological scenario and BT as an organisation

- If not managed and coordinated continually over time, tension release may occur suddenly and unpredictably causing significantly greater damage to the organisation than had it been gradual and planned.
- As with the earth's crust, one of the functions of an organisation is contain internal changes, and prevent them from affecting adversely the environment in which they exist. Otherwise they may start ***sequential***, ***continuous*** chain reactions externally that result in the organisation's viability and continued existence within that operating environment becoming untenable (eg: public confidence falls, and market share is eroded by other competitors).
- Initiating changes at the level of Cultural Profile (Behaviour & Style Project) - if correctly managed - will have knock on effects up through the other layers over time until they become evident to the external observer as positive, ***melioristic*** changes in Customer Service and Financial Position. If the natural dynamics at the level of Behaviour Profile and Cultural Profile are not attended to, or incorrectly measured and diagnosed, the resulting behaviours and attitudes that ensue will prevent effective Process Flow, hamper control and communication at the Structural Composition level, finally bubbling up to affect levels of Customer Service and profitability.

Clearly, issues of perception and measurement are closely tied in with this metaphorical analysis. No organisation likes the outside world to see its dirty laundry or natural internal growth pains. BT would rather have control over what the external observer sees, and for most of the time, would probably wish to confine viewing to the Customer Service and Financial Position levels. If these two levels are to be kept in a healthy state, then the change dynamics at lower levels must be carefully managed and the friction and energy they generate must be creatively channelled. Otherwise, employee moral and satisfaction will erode, and given time, there will be periodic eruptions and instabilities at the 'surface': falling customer service ratings, declining organisational effectiveness and market share, increased trade union activity, and poor profitability.

One aspect of BT's current situation which this geological comparison does not capture, is the extent of the external environmental forces which are putting increasing pressure upon the company. For example, the gradual deregulation of the market and the increasing number of competitors which are entering the industry. Also, the constant demand and necessity of trying to keep up with the rapid advances in telecommunications technology. In discussion with the ERCMU, it was suggested that atmospheric processes of erosion on the earth's crust might be one way of modelling these environmental forces. For example, wind, water flow, solar heat and ice are all capable of changing the uppermost surface of the earth. However, it was felt they were not sufficiently intense and forceful enough to capture something of the large scale, second-order changes taking place in the wider telecommunications industry outside BT. Such atmospheric erosion change processes typically operate over long periods of time in an incremental manner. Therefore, this further line of analogic reasoning was not pursued.

Three other metaphors were also considered. They were not explored in detail using the steps above because they were not specifically natural or physical science phenomenon. But they did yield some insight and so are reviewed briefly here.

7.5.2 Ship Metaphor

During the first week of October 1994, the Russian passenger ship MV Estonia sank crossing the Baltic sea with the loss of 900 lives. To the external observer, she appeared a large, solid and sturdy ship proudly riding through the waves with an air of invincibility. And yet, she was unexpectedly claimed by her environment with tragic loss of life. Figure 7.7 highlights the main BT parallels. This metaphor does attempt to capture the external environmental forces arrayed against BT - something the geology metaphor did not focus upon. It is based upon the premise that the company may not posses the ability to react quickly enough to a sudden change in its environment - even if that change is known about in advance and is a contingency that has been planned for.

During discussions of this metaphor, ERCMU management took the view that the industry regulator would not allow BT to 'sink'. Rather they believed that the regulator will permit different environmental forces to assail different companies 'sailing' in the same market, thereby restricting their movement and ensuring fair

MV Estonia Ferry Situation	**British Telecom Parallel**
External perception: Ferry ship appears solid, proud and stable.	External perception: BT has Government support; protected industry; 'safe investment' image; unlikely to 'sink'.
Waves and motion of the sea.	BT's environment: competitors, aggressive predators, deregulated market place, rapidly advancing technology.
Disaster: bow doors opened.	Complacency of a privatised company with a protected market share, confident in its superiority & invincibility; unaware of own its weaknesses and vulnerabilities.
Cause: Captain and crew error?	Poor management; internal inefficiencies; lack of foresight and business sense; lack of understanding of market forces at work.
Sudden, unexpected sinking.	Potential for rapid demise due to internal stresses and tensions building up, coupled with some extreme environmental disturbance.
Tragic loss of life.	Potential for further major job losses should BT become unprofitable or be taken over.

Figure 7.7: MV-Estonia metaphorical comparison

competition overall. Should one company appear to be suffering from a competitive disadvantage, the regulator will change the rules of the sea (barriers to entry in certain market segments) to ensure all market entrants stay afloat. However, the author's view is that if *internal* operations, structures and processes are not efficient and effective, the ship may still sink despite the best efforts of the regulator to save it. BT has a clear responsibility to keep its own ship in order - otherwise the regulator will be guilty of subsidising and protecting an inefficient bureaucracy. Maintaining employee morale and ensuring behaviour and style is conducive to flexible and effective operations is clearly the role of BT management, not the regulator.

This metaphor then, provided some vivid imagery with which to explore different views and perspectives on the context within which organisational change occurs. It proved a useful basis for discussion and debate.

7.5.3 Moving House Metaphor

When moving house, the physical aspects of the transition occur quickly: the movement of furniture and personal effects are normally completed within 48 hours. However, the emotional aspects of the move take much longer to occur: getting familiar with the new house and locality; adjusting to the new environment and generally settling in.

Figure 7.8 shows some of the metaphoric mapping possible here, and parallels with recent BT changes.

7.5.4 Swarm Metaphor

The internal changes and external direction of BT since privatisation can be likened to the motion of a swarm of bees. At the micro level of the individual bee, motion and direction is somewhat erratic and far from uniform. This individual energy is dissipated throughout the rest of the swarm and manifests itself in at least two identifiable emergent properties at the level of the whole. Firstly, the swarm changes shape continually as it moves towards its objective. Secondly, viewed over time the swarm does achieve purposeful motion through the air in a given direction.

Moving House Situation	**British Telecom Parallel**
Moving house	Undergoing organisational change (Breakout and Behaviour & Style).
Long build up and planning for the move involving several parties: Estate agents, Solicitors, Surveyors, Building society etc.	Planned change requires Intelligence, Design and Choice activities to be undergone, involving internal and external stakeholders, management consultants etc.
Changing geographic location.	Changing organisational structure, processes.
Sorting out of possessions prior to and during the move.	Rationalising staffing, processes and technology during the change.
Physical move takes place over 24 - 48 hours.	Once decided upon, structure, technology and process changes can be implement in a short space of time.
Emotional transition and adjustment to the new house can take months.	Associated behavioural changes will take longer to become established and adjusted to (Behaviour & Style project).
Way of life, attitudes, values and habits may not change despite the house move.	Organisational culture may not change, despite the implemented structure and process changes.

Figure 7.8: Moving house metaphorical comparison

Likewise, since privatisation in 1984, BT has undergone numerous internal changes as discussed earlier and these can seem somewhat sporadic and discontinuous to the external observer. However, over time it is the view of the ERCMU that there is continuity and purpose in these internal dynamics, as BT seeks to transform itself from a Government owned monopoly into a competitive and successful private company operating in a deregulated market.

7.6 CASE STUDY (I) CONCLUSIONS

The application of the change framework during this case study aided analysis and description of the change phenomenon under investigation. It provided a focus and reference point for the analysis, prompting questions and second loop (Argyris and Schon, 1978), deeper exploration than would have been possible in any of the author's previous analyses of organisational change scenarios. It will be noted that few of the ***principles*** (GPC's) of the change framework were identified and seen at work during the course of the case study, with the exception of ***metastability*** which was discussed in relation to one potential ***outcome*** scenario (section 7.4.2), and ***feedback***. Feedback processes were clearly at work in the formation and reinforcement of the current culture since privatisation. Moreover, the ERCMU have identified positive and negative causal feedback loops in their analysis of the ten key behavioural dimensions - shown in Figure 7.3, and it is anticipated that these will help reinforce the desired changes in behaviour and style once they begin to occur. However, whether the identification of only two GPC's at work is an indication that the universality of the rest is questionable, or whether one case study is insufficient to test for them, is difficult to assess.

In terms of the metaphor applications, it was hoped that more than one physical/natural science phenomenon could be employed. Nonetheless, the one that was explored in some detail (geology) generated much discussion, and in terms of being an aid to creative learning, proved to be a powerful tool. Indeed, exploring the current changes BT is undergoing through the lens of all four metaphors provides several very different, insightful perspectives - each drawing out a separate theme or highlighting a particular change dynamic at work. In communicating the precarious position of the organisation to senior management, they represent powerful images of what change dynamics the company currently faces, and what the future out workings of those dynamics could result in, if they are not anticipated or countered. This use of metaphor to provide a plurality of perception is not dissimilar to the Root Definitions produced by Checkland's (1972) Soft Systems Methodology, but has a far more diverse conceptual foundation and offers significantly greater creative thinking potential.

The development of the geological metaphor suggested that at the level of behaviour and culture, organisations generate energy and powerful forces that must be dissipated and channelled creatively up through the higher levels. In this way growth and change is achieved internally, while at the same time, external perceptions and expectations can be managed effectively. Prior to the Behaviour and Style Project, BT's change initiatives focused on and started at higher levels - namely structure, process and strategy (see earlier list in section 7.3). As a result, the changes only created continual upheaval. In the words of one external observer, "...the modern BT remains in bewildering permanent revolution. They keep taking the medicine but they never seem to get better." (Goodhart, 1995). Now however, with the advent of Behaviour and Style, senior management are attempting to acknowledge and harness the power and energy that lies latent at the deeper cultural and behavioural levels. Only history will show whether the Behaviour and Style project will be able to make use of this to achieve the behaviour change that is necessary, in order to erode the current corporate control-fear-blame mentality, and stimulate an innovative, adventurous and open working culture.

CHAPTER 8

ORGANISATIONAL APPLICATION (II)

First Brand International Case Study

"A state without the means of some change is without the means of its conservation."

(Burke: 1729 - 1897)

8.1 INTRODUCTION

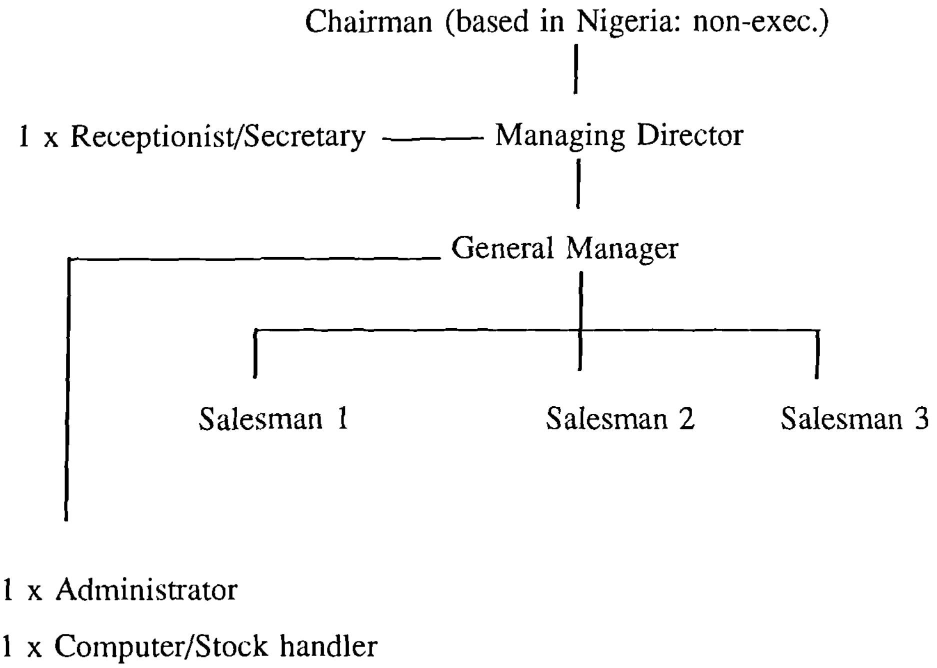
This chapter discusses the second case study that was undertaken during the course of the research. It describes the application of the framework outlined in Chapter 6 to a company called First Brand plc - and its subsequent transition into First Brand International plc. A brief history and background to the case study is given. This is followed by an application of the framework to two specific changes - one strategic and one structural - which enable the organisation to transform itself and remain viable in a hostile environment. As the opening quote suggests, the theme of this second case study is 'conservation through change'. The chapter concludes with a summary of the main points.

8.2 BACKGROUND AND BUSINESS SCENARIO

<u>First Brand plc</u>: <u>January 1993 to December 1994</u>

The Essex based company First Brand plc (hereafter referred to as FB) was set up with a view to entering the UK drinks market. Starting with £100,000 capital provided by the stakeholders, FB was awarded sole UK distribution rights for Don Simeon drink products manufactured in Spain. Don Simeon is a brand name of J.C. Carrion SA - the largest drinks company in Spain, based in Jumilla. Don Simeon is a well known drinks brand name on the continent, particularly in Spain, France, Portugal and Italy and J.C. Carrion had been attempting unsuccessfully to introduce it to the UK for over eleven years.

The organisation structure of FB during the first 12 months of trading was as follows:



The initial problem was entering a market for which FB had no expertise. The recruitment of a General Manager and three Salesmen with over 50 years experience of drinks retail and distribution between them, was seen as sufficient to counter this weakness. The two main challenges facing FB during its first year were:

- To enter successfully a new market as an unknown company.
- To introduce a new and untried product range to the UK market, in direct competition to well established brands.

Products included both soft drinks and alcoholic lines such as wines and spirits - all of which were imported from Spain.

<u>Early Problems</u>

After 8-9 months of trading several problems became apparent:

1. The initial forecasts and projections on sales, turnover and customer base (provided by the General Manager) were not being met.
2. There was a realisation that the product range was too wide for such a small company with limited cash flow. Not every item could be kept in stock at a level sufficient to meet all customer demands.

3. The Sales staff were not used to working for a small company where payment timing on secured orders was crucial. Operations relied upon efficient cash flow and minimal stock holding - a regime unfamiliar to them.
4. While there was no import duty to pay on goods transported within the EEC, UK Customs Duty was payable on alcohol products as soon as they were moved from bonded storage. This proved a considerable drain on FB cash flow resources - due to 60/90 day credit arrangements with customers, FB would not recoup its money for some months following Customs release.

Further capital was sought from the stakeholders, who provided an additional £35,000. Another Salesman was recruited in September 1993 who proved very effective in increasing new accounts by between 200-300, particularly for non-alcoholic drinks. His individual success demonstrated that:

- o The brand name was acceptable to the UK market.
- o Products were not overpriced.
- o The initial Sales team were not performing adequately.
- o FB soft drinks were more saleable than alcoholic products in the prevailing market.

In November 1993 the General Manager was sacked and the business began to focus on the soft drinks business exclusively. At the end of the first year, annual turnover was £65,000 - well below projections and expectations. Inability to gain contracts with the large retailers was seen as one of the main reasons for this poor performance. The larger supermarket chains often had their own *direct* suppliers and were beginning to introduce drink products of better quality than before, under their own brand name. In addition, they required a commitment to massive financial investment in marketing and product development from FB before even considering a possible contract. Such large cash reserves were not available to FB.

<u>Second Year of Trading</u>

During the first quarter of 1994 FB began to realise that the drinks industry was not an easy market to enter for small new firms, particularly those with a virtually unknown product line. By the second quarter most of the Salesmen had resigned or been sacked due to poor performance and the support staff were reduced to one receptionist and one administrator.

In June 1994 a new Export Director was appointed to J.C. Carrion. FB attempted a final marketing promotion of its products to all the major drinks retailers in the UK. However, despite a favourable response from many, (including Morrisons, Asda, Iceland, Marks & Spencers and Gateway) an agreeable supply price could not be reached with J.C. Carrion. The prices they quoted for supply were higher than those previously provided. Moreover, elsewhere in Europe, they were supplying to similar major buyers at lower prices than those being asked for by the interested large buyers in the UK.

This rebuff from the new Export Director confirmed to FB management that J.C. Carrion no longer wanted to deal with FB as its sole UK distributer for Don Simeon products. On August 1st 1994 the decision was taken within FB to stop trading in drinks completely. All remaining drinks stock was sold off, much of it going back to the supplier J.C. Carrion. During October 1994 new stakeholders provided additional capital with which FB began to reduce its debts. (From £75,000 to £3000). One Salesman was kept on a freelance/contract basis. In October 1994 J.C. Carrion filed an insolvency claim against FB in an attempt to revoke the sole distribution rights it had granted for Don Simeon products.

Change of Direction

In January 1995 FB as a legal entity was dissolved and First Brand International plc (hereafter referred to as FBI) was established in its place. FBI had the same management as the old company FB, but all links with J.C. Carrion were broken. The new company changed direction and began to explore other markets and business opportunities. The aim was to make use of any internal business sector expertise which it already had, and to begin building a network of experts and specialists it could call upon, on a contract/freelance basis. To date, current business activities include:

- o <u>Commodity Broking</u>: Ginger and coal, with negotiations under way to secure contracts for various oil fractional distillates.
- o <u>Mining</u>: Open cast excavation for shallow bed mineral deposits in Nigeria; joint venture with a Spanish mining company.
- o <u>Foreign Exchange</u>: A wholly owned subsidiary called Ambit, setup in July 1994, to process and invest foreign exchange earnings in Forex dealings, in order to exploit short term exchange rate fluctuations.
- o <u>Wood Furniture Products</u>: Importing unfinished wood furniture products from Nigeria, and polishing and finishing them on arrival before retail to the UK market.
- o <u>Automobile Association</u>: Analysis is currently underway to investigate the viability of setting up an AA type service in Nigeria.
- o <u>Delta Steel Refit</u>: Negotiations are currently in progress with the Nigerian Government to secure a consultancy contract overseeing the refit of Delta Steel - a major Government owned steel plant - prior to privatisation.

As can be seen, the current business portfolio has a considerable focus on Nigeria reflecting the interests and connections of FBI's senior management. Nigeria has an expanding economy and offers numerous commercial opportunities for investors with local knowledge and contacts. This is one of the key strengths which FBI is seeking to make full use of, as it transforms itself from a UK based drinks distributor to an international entrepreneurial business centre. Essential for success will be acquiring the right balance of skills and expertise to operate in these new and challenging markets. Prosperity for FBI will mean having the appropriate resources available *at the right time* to exploit business opportunities as they present themselves. Flexibility, foresight, vision and above all, a good contact base of clients *and* free lance business specialists will ensure that FBI reaches the next millennium in a strong financial position.

8.3 THE FRAMEWORK APPLIED

While charting the business history of the company and undertaking the case study, two significant transitions were identified. Firstly, the distinct shift in strategic direction made by senior management. This was followed by a second change in organisation structure, to support this new strategic thrust. These two transitions will now examined using the change framework outlined in Chapter 6.

8.3.1 The Change in Strategic Direction

The ***focus*** of this change was clearly ***strategy***. The Board and senior management decided to move out of the drinks business and target other markets. A new strategy for business development was formulated while FB was still trading in drinks, and was the result of several brainstorming sessions in which other potential markets were identified.

The SOURCE categories for this change in strategic direction can be classified as follows:

Action:

1. - The decision by J.C. Carrion not to quote a competitive supply price for potentially lucrative UK contracts. (***Precipitating***)

2. - The attempt by J.C. Carrion to revoke FB's sole UK distribution rights. (***Triggering***)

3. - Decision by the FB Board not to inject further investment capital in the business. (***Permitting***)

Process:

4. - FB's inability to get a foot hold in the UK drinks market and secure contracts with major buyers, during the first year of trading. (***Predisposing***)

5. - Poor performance and inflexibility of the Sales team recruited to promote the Don Simeon brand. (***Predisposing***)

6. - Lower than predicted turnover and no operating profit during the first 18 months trading. (***Precipitating***)

The change ***type*** was classified as ***natural***. That is, it was not part of a long term premeditated plan to switch out of the drinks business and diversify into other areas. It can be argued that the strategy transition formed part of the organisation's natural life cycle (Cameron and Whetten, 1981) - a precursor to actual structural change, but a definite and essential first step in the creation of a new organisational identity.

The ***embedded dynamic*** which most closely parallels the change in strategic direction undergone by FB was ***metabolism.*** The cycle of interacting with the commercial environment, receiving resources and encountering business opportunities that could be converted successfully into revenue to fuel further growth and expansion, is essential for any organisation. FB seemed unable to maintain a high enough metabolism to remain a viable organisational entity in their chosen market. However, they were capable of maintaining sufficient resources to undergo change at a strategic level, and convert themselves into another form to keep a hostile environment from eliminating them.

In terms of ***attributes***, this change can be classed as largely ***deterministic.*** The strategy evolved in a ***continuous***, logical, and ***sequential*** manner, with the mechanisms for the change being strategic review meetings held by the Board with senior management in response to the change ***sources.*** Certainly, it can be argued that the strategy eventually arrived at is in principle ***reversible***, in that FB could decide to re-enter the drinks market at some future date. However, at present this does not make good business sense. From an epistemology standpoint, the change could be described as ***positivist*** in that a common understanding and consensus had been achieved.

Corporate strategy change occurs at the macro ***level*** of the organisation. Close analysis and measurement of the dynamics of its own work force and the drinks market of which it was a part, enabled FB to make the necessary changes at a strategic level. The correct level of detail was examined to ensure that changes in the Managing Director's strategic rhetoric was informed by careful observation and measurement of the operational realities and practical endeavour of the employees at the micro level. The small size of the company enabled management to keep up to date with the gradual decline in orders and sales revenue. This is one example of where the "Boil a Frog" metaphor is not an adequate representation of reality, because the organisation was not lulled into inactivity and was able to change its disposition towards the environment very effectively.

The ***resistance*** category of the framework could not be applied usefully within this case study. No resistance to the change in strategy was detected, or the structural changes that resulted from it. Senior management eliminated the major potential source of resistance - namely the Sales team - by sacking most of them. The administrative and support staff appreciated that the changes were essential if the company was to avoid making further staff cuts and therefore supported them fully. The Board offered no resistance. On the contrary, it even committed to providing further financial support for some of the proposed new ventures. J.C. Carrion were seeking to sever links with the company anyway and actively encouraged First Brand to exit the drinks market with their judicial action. The nearest category which could be said to fit here is ***fragile resistance***, but even this over-represents the degree of resistance that was actually present in the situation. The staff knew that unless the company changed direction, they could well have been made redundant. Once this realisation dawned corporately, what fragile resistance there may have been gave way very quickly.

One of the change ***principles*** developed in Chapter 5 which can be seen at work within First Brand is that of ***environmental coupling***. The changes both in strategy and organisation structure were a function of the company's own internal composition and identity, and were in essence ***autopoietic***. That is the organisation underwent change making reference to itself and its own identity. First Brand was structurally coupled with its environment, in terms of its relationship with its continental supplier J.C. Carrion and the multitude of buyers who represented its customer base and domestic market. Deteriorating relations with J.C. Carrion resulting in increasingly uncompetitive supply terms, forced First Brand to redefine its basis for commercial existence, but only in terms of the latent skills and resources it *already possessed.* The under-performance of the Don Simeon brand name within the UK caused Senior management to review their corporate strategy, making changes which were centred upon their own existing strengths and weaknesses. The changing relationships which First Brand had with its environment were *internally* determined. The company's identity and future existence were intimately tied in to its environment, as Morgan (1986) has explained:

> "...a system's interaction with its 'environment' is really a reflection and part of its own organisation. It interacts with its environment in a way that facilitates its own self-production, and in this sense we can see that its environment is really part of itself." (Morgan, 1986: 236)

The final strategy and organisational structure arrived at reflected abilities, resources, contacts and expertise which First Brand already had, but was not exploiting. By redefining its goals and operational structure to ensure its own continued existence, the company essentially redefined its environment.

In terms of the ***outcome*** of the change in strategy, as far as can be observed it is ***stable.*** No further changes in strategic direction are imminent. No immediate pressures or ***sources*** for additional strategy redefinition can be identified. At the time of writing, steady growth was being achieved across a range of business ventures, suggesting that the new strategy was appropriate and in no immediate need of modification.

The ***degree*** of change here could be classed as a series of slow and ***first order*** transitions. FB had been exploring other potential business areas for some time, with the intention of using the drinks business as a cash cow to fund investment in other activities. The strategic shift had occurred gradually over a long period, with a temporary, intermediate strategy of diversifying while remaining in the drinks market. This evolved further following the recruitment of the additional Salesman in September 1993, into a strategy of staying with non-alcoholic products only (as these were selling well) as well as continuing to diversify into other activities. The final policy which marked the end of these incremental shifts in strategic thinking was to abandon the drinks business altogether, and focus on alternative markets. On the other hand however, viewed merely in terms of an initial state (declining drinks business) and final state (profitable diversified business centre) it can be argued that the organisation has undergone a ***second order*** change and transformed its identity. This demonstrates the importance of attempting to identify intervening transition stages over time for a given transformation, and not just interpreting the change in terms the perceived difference between initial and final state. A case can be made then, for both second and first order change, depending upon the position and interest of the observer.

8.3.2 The Change in Organisation Structure

The second change explored during this case study had as its ***focus*** the organisation ***structure***. That is, the configuration of human and material resource employed to achieve the strategic objectives of the company. The main ***sources*** behind the restructuring were identified as follows:

Process: **1.** - The change in strategy, involving the decision to diversify business activities and withdrawal from the drinks market. (***Triggering***)

2. - The draining of start-up capital with no return on investment, prompting an in-depth examination of internal costs and overheads. (***Predisposing***)

Information: **3.** - The low sales figures prompting a reduction in the size of the Sales team. (***Precipitating***)

The change ***type*** can be described as ***planned.*** It involved a series of meetings to design and schedule structural changes which would facilitate the emerging corporate strategy. In terms of change ***levels***, the transition occurred across the whole organisation from senior management downwards, affecting roles, functional responsibility, lines of reporting and communication.

As the change in structure was planned, it is appropriate here to discuss ***methodology***. As with the changes discussed in the previous chapter, no formal, explicit methodology was followed by the organisation to achieve the desired change. Starting from the point at which the new strategy for FBI had been drafted, clear steps can be identified:

Intelligence activities included:

- o Determining the working assets, skills and resources available, from which a new structure could be created for the company.

- o Assessing the structural implications of the various business openings and opportunities that represented FB's possibility space.

Design and ***Choice*** activities involved:

- o Creating the most suitable structure that would efficiently and effectively employ the human and material resources available, to exploit the business opportunities identified.

Implementation activities included:

- o Reorganising the company in line with the structure designed.
- o Instituting multi-skilling and exchange of expertise as part of an on-going training programme.

The ***attributes*** of the structural changes can be described as ***sequential*** and largely ***deterministic***, being carefully planned and managed. However, unlike the strategy change, the structural changes were ***discontinuous***, with first the recruitment of a four man sales team, followed by the addition nine months later of an another salesman. Over the next eight months the original four either resigned or were dismissed in a planned reduction in sales personnel. Reductions were also made during this period in administrative and support staff. The following six months saw a major redefinition of jobs, functions and roles for the remaining staff involving considerable retraining. Formal links were also established with several external freelance contractors, who were able to provide additional expertise and human resource at short notice. While each of these structural changes was individually planned, they did not occur in a smooth continuous manner and even with hindsight, lack continuity in and of themselves. It is only the strategy changes occurring over the same time period, at a different ***level*** of analysis which provide the key to interpret the structural changes, giving them purpose and cohesion.

As with the change in strategy, ***resistance*** to the structural change was hard to identify. The Sales team were the main source of resistance. They either removed themselves by resigning, or were forcibly removed by sacking. Hence the resistance was preempted by removing it prior to the commencement of the change. The administrative, support and contract staff showed no signs of resisting the planned changes in structure. Indeed, it could be argued that the principle of ***least resistance*** was at work here. The proposed changes made use of an existing 'fault line' or weakness embedded within the organisation's culture: fear of redundancy. The remaining employees coalesced easily into the new structure, with no dissenting voices. The uncertainty and job insecurity was consciously exploited by the Managing Director to introduce the new functions, roles and areas of responsibility, in the knowledge that this change route was likely to present the least problems during implementation.

The ***outcome*** of the structure changes appears to be ***stable***, but it is too early to tell whether it will remain so. The new organisation functions following the structure changes can be represented as shown below:

Chairman

Managing Director

AMBIT (forex) | Import/Export Operations | Nigerian Ventures | New Business Ventures

As the new business ventures grow, it is likely that the structure may need to be changed yet again to ensure that adequate and efficient resources are available to maximise return on investment. Lines of control and communication may need to be modified as more staff are recruited. But for the next two years at least, senior management deem the new structure appropriate and capable of supporting the business as it develops. Each of the four areas has one 'owner' responsible for existing business development, with all other staff rotating through and acquiring knowledge of each as the business grows. Freelance contractors only contribute to specific functions in their field. The role of the New Business Ventures function is to search actively beyond the organisation's existing sphere of influence and expertise, for any new market opportunities, products or ventures which could be added to FBI's current portfolio.

Viewed over a short time scale at an operational level, the ***degree*** of each change in structure can only be described as ***first order***. Each pushed the company away from a traditional hierarchical sales driven organisation. Analysed and interpreted over an extended time scale of two and a half years, the structural change can be seen as revolutionary and of ***second order***, with the entire focus, management style and direction of the company dramatically changed. This again illustrates the importance of considering scale and perspective when examining change phenomena.

Several metaphors were considered as possible candidates for detailed analogical analysis using the steps outlined in Chapter 3. However, following discussion with FBI management, none of the metaphors appeared to offer further significant insight into the changes under study, and were therefore not developed formally. Two possible reasons for this are given in the concluding section below.

8.4 CASE STUDY (II) CONCLUSIONS

As FBI diversifies and transforms itself into a business conglomerate, it will be *driven* by requests from external suppliers seeking a brokerage service for their products. Certainly FBI will attempt to be selective and maintain control of what partnership requests it responds to, but the direction and speed of development will largely be dependent upon others. This makes it fundamentally reactive. Hence, as FBI evolves, it will be changing and transforming itself according to chance encounters with, and opportunities within the environment and market place, *not* by some internal action plan to change the organisation from one state to another through a series of linear steps. That is not to say there will be no strategic vision and business plan. On the contrary, there is at present a very clear strategic vision, but it relies upon a certain opportunistic style of management. Bounded instability will be maintained as senior management seek to retain some control over which activities and ventures they engage in, while at the same time being open and eager to consider whatever business opportunities present themselves - regardless of the tensions, contradictions and ambiguities they seem to create for the existing organisation structure in the short run. The Managing Director of FBI has come to realise that in the long run, such tensions provide the energy, opportunity and competitive edge to move into new markets and stay ahead of the competition.

Having learnt from the mistakes of the past, FBI is now adopting a radically new strategy to take it into new business activities:

- o A flat organisation structure, with accountability and responsibility being shared among *all* employees. Business area expertise, product knowledge and specialisms will be the forte of all, as every individual within the organisation shares knowledge and adds value, by making use of skills previously unutilised.

- o Focus and ownership will be shared among all individuals so that no part of the business becomes isolated and unknown to the rest of staff. This way, contacts and networking with suppliers and specialists outside of FBI can be maximized with cross fertilisation between business developments. Here we see parallels with chemical bonding and enzyme phenomena: the links between internal parts of the organisation are strengthened while at the level of the whole, the organisation ensures it can flexibly orientate itself to forces and opportunities outside in the environment. Internally at the micro level the bonding is strong. Externally at the macro level, the bonding is weak and possibly even one of attraction, to draw in and secure business.

- o Emphasis and high priority placed on staff training, to facilitate the sharing of business expertise and experience in specific areas. Particularly the learning of the vocabulary that goes with each specialism: eg commodity broking; import and export trading.

- o Recruitment policy rethink: avoidance of those with a "big company mentality" who are not in tune with the dynamics and fragility of a small, new business. This policy will also ensure that any new employees will eventually be able to fit inside the existing 'lattice structure' and will not pose a de-stabilising threat to the new regime

As with the BT case study, the change framework from Chapter 6 proved to be a helpful analytical tool for exploring change activity within the organisation. There was not as much access to company information as there was with BT, but nonetheless, the framework was a useful conceptual tool for framing the right questions to ask during interviews. In this way, it was possible to uncover change activity and dynamics occurring which the formal documentation and management rhetoric did not acknowledge. For example, the implicit use of 'fear of redundancy' to ensure compliance with the emerging strategy and subsequent new structure.

The inability to find a suitable change metaphor to explore the company's transformation was disappointing. There are two possible reasons why this was so. Firstly, because the company was relatively small compared with BT, there was a tendency to view change dynamics in terms of personalities. This focus on the micro level obscured some of the more fundamental shifts that were taking place at a higher macro level, within for example, the drink markets and the strategic objectives of the Board. Secondly, the nature of the changes being studied could be viewed through *parts* of several metaphors with a few specific isomorphic mappings from each, but not enough of one in particular to warrant an in-depth comparison. For example, the strategy change discussed in this chapter embodies aspects of autopoiesis, ageing, metamorphosis and evaporation - but none sufficiently to 'operationalise' the metaphor formally.

CHAPTER 9

REFLECTIONS AND CONCLUSIONS

> *"How do we come to think of things, rather than of processes in this absolute flux? By shutting our eyes to successive events. It is an artificial attitude that makes sections in the stream of change, and calls them things.... Life is no thing or state but a continuous movement or change."*
>
> (Radhakrishnan, 1925: 155)

9.1 INTRODUCTION

This thesis has highlighted a need for greater research attention to be given to the *nature* of organisational change. An investigative approach has been developed and pursued, leading to the proposal of an initial descriptive framework for change. This has been applied through case studies to two organisations. In closing, this final chapter summarises the main achievements, original contributions and conclusions of the study, and discusses a number of areas where it is felt there is significant potential for further research.

9.2 CONCLUSIONS AND ACHIEVEMENTS

The main findings and achievements of the study can be summarised as follows:

1. <u>Highlighting the Need for Greater Research into the Nature of Change</u>:

The increasing rate of change and its importance was discussed in Chapter 1. As the social, technological, and economic systems that span the globe become ever more complex and interdependent, the planet appears to shrink. As a result, the effects of a given change are ever more rapidly and keenly felt, highlighting the urgent need for a deeper understanding of the nature and dynamics of change itself. Within organisational systems specifically, the lack of emphasis on exploring the nature of change has been demonstrated. Historically, the thrust of most research has focused upon how change can best be managed, and little attention has been given to the fundamental nature of change. The thesis has attempted to highlight this gap in the literature, by exposing what is considered to be the weak conceptual and theoretical base of organisational change thinking. A number of theorists who have begun to explore the notion and phenomenon of change were discussed in Chapter 2. These represent genuine attempts to investigate and understand the fundamentals of change. Clearly though, much more needs to done. The proliferation of recipe based organisational change approaches and methods has kept research attention diverted away from exploring *what* the nature of change is, in favour of examining *how* it can best be managed (the latter being a more lucrative research opportunity in the short run).

2. Proposal of a cross discipline approach with which to explore the nature of change:

A five stage approach has been developed and proposed during the course of this research. Based upon a General System Theory philosophy, the approach was designed to investigate and collate different perspectives and descriptions of change from other subject domains, in a structured manner. As discussed in Chapter 3, some theorists have advocated similar approaches to organisational analysis. While these represent a useful beginning and an aid to creative thinking, they have however been rather limited in their conceptual scope and practical application. The GST style approach developed during this research is arguably more cross-discipline in nature, and has produced conceptual output of use to both the theorist and the practitioner. The approach also proposes a structured method to exploit the creative potential of metaphorical thinking - capable of greatly enriching the analyst's descriptive ability, and enabling him to identify the unusual and more profound aspects of a given change scenario.

3. Exploration of various change perspectives, phenomena and concepts

The thesis has investigated a selection of change phenomena, concepts and descriptions from a wide range of subject domains. In Chapter 4, the main ontological and epistemological positions were discussed, looking at issues of perception, measurement and interpretation with respect to change. A number of perspectives and definitions of change were also examined, from both the physical and social sciences. Chapter 5 then explored a variety of change phenomena, taken from the subject domains and sub-disciplines of physics, chemistry and biology. Key principles, themes, attributes and common concepts describing change were highlighted, and where appropriate, their metaphoric and analogic potential was discussed. All this work produced a greater understanding of change generally, and more specifically, has provided a context and conceptual base from which to explore the nature of organisational change itself. Clearly, only a limited number of discipline perspectives could be examined during this study, but they did reveal sufficient recurring themes and unifying ideas to demonstrate that the GST approach developed here has utility. Moreover, in surveying a cross section of concepts and representations of change from a variety of disciplines, the potential power and utility of metaphor and analogy has been highlighted.

4. Proposal of an initial change framework

An initial framework has been proposed by this thesis in an attempt to describe the fundamental nature of change. Building on (2) and (3) above, this can be regarded as the most important part of the research. It endeavours to capture some of the basic issues, principles and attributes of change and represents a synthesis of a number of perspectives, phenomena, descriptions and change concepts from a range of subject domains. The framework has been advanced as an analytical and descriptive tool, for investigating change within organisations specifically. Nevertheless, given the multi-disciplinary foundation from which the framework was derived, it is anticipated that it may have utility for those attempting to better understand change within other subject areas. The major components of this framework are summarised in Figure 6.1, and it is hoped that future research will be able to expand and modify it further.

5. Application of the framework to organisational change situations

Having developed the framework and gained a deeper insight into the nature and dynamics of change, an initial attempt has been made to apply this knowledge to actual change situations and assess the framework's descriptive and analytical utility. This has been done through two organisation based case studies. The first examined cultural and behavioural change (British Telecommunications) and the second focused upon strategic and structural change (First Brand International). The results of these case studies are discussed in Chapters 7 and 8 respectively. While clearly limited in scope, they do demonstrate that the framework has sufficient utility and benefit for both the theorist and the practitioner to warrant further development. Specifically, the application of the framework demonstrated the following:

- It is capable of providing a structure to change analysis, and a means of categorising the various events, processes and other components that collectively make up the organisational change phenomenon under investigation.
- It permits a deeper insight into some of the underlying dynamics of the change scenarios, and a rich descriptive language with which to express them.
- It can initiate and facilitate debate and discussion with the management and staff involved, about the nature of the change being experienced. The creative use of metaphor was of great importance here.

9.3 A QUESTION OF METAPHOR

This study has highlighted an important issue related to the transference of ideas and concepts from one subject domain to another - in particular, from the natural and physical sciences *to* the social sciences. Social systems such as societies or organisations are composed of intelligent, sentient individuals capable of purposeful decision making in an attempt to influence their future. Physical systems on the other hand, arguably possess no such conscious or cognitive ability, being made up of electrons, atoms and molecules. This distinction raises an interesting point of debate. Can the concepts and phenomena being abstracted from the source domain be said actually to exist in the target domain, or are they merely being used in some metaphorical sense to draw out parallels and make comparisons between the two disciplines? Most of the theorists discussed in this thesis who have explicitly taken concepts from one discipline and applied them in another, have not addressed this question. The reader is often left to make his own judgement on whether their use is real or metaphorical. Indeed, at a recent workshop on chaos theory applications within the social sciences, none of the speakers explicitly stated their position on this issue. Afterwards, the author conducted a survey on the point from those who had presented papers. The response was split between those who viewed the identification of chaotic attractors and fractal structures within their target social system as *real*, and those for whom it was merely a metaphoric comparison. One individual declared after some thought, that he honestly did not know and had never considered the point. If the above survey is considered representative, it demonstrates that there is considerable ambiguity amongst researchers on the matter.

Two theorists have made their position clear. Zimmerman (1992) uses the phenomenon of a dissipative structure in physical science (discussed in Chapter 5 section 5.3.9) to describe self-organising social structures such as organisations. She warns against taking metaphors literally:

> "A caution is necessary about the risk of mapping from the physical to the organisational or to the cognitive levels of analysis. The objective of this comparison is not to show definitively that self-renewing organisations *are* dissipative structures. Instead the metaphor of dissipative structures may shed light on some dimensions or ways of understanding organisations to enhance the management of co-evolution. The use of metaphor is merely the first stage in the process. (Zimmerman, 1992: 12 - emphasis added)

Wheatley (1992) on the other hand, takes a different view. While acknowledging the use of metaphor for description, she argues that some natural science phenomena can actually be identified within organisations. As an example, she uses the phenomenon of a field (discussed in Chapter 6 section 6.9) to conceptualise customer service within a chain of retail stores:

> "At one level, thinking about organisational fields is metaphoric, an interesting concept to play with. But the longer I have thought about it, the more I am willing to believe that there are literal fields within organisations. I can imagine an invisible customer service field filling the spaces of...stores...helping to structure employee's activities, and generating service behaviours whenever the energy of an employee intersected with that field."
> (Wheatley, 1992: 53)

Whichever view one holds has serious implications for measurement and system intervention activities. Therefore, this issue needs to be articulated and better understood by theorists, if effective methods and approaches are to be developed which can harness the enormous potential of cross-discipline transference of ideas. Within this thesis, concepts and phenomena of change were only employed metaphorically to aid description, stimulate discussion, and encourage a deeper conceptual understanding of the change phenomenon under investigation. For example, the Embedded Dynamics of *kinetic energy*, *potential energy* and *competing forces* (EDC's 1, 2 and 3) discussed in Chapter 6, are merely an attempt to demonstrate that an important component of change in any system, is the background noise of micro level friction and chance encounters between system elements - whether they be molecules or human individuals. Clearly, there is not an exact one to one mapping between Brownian motion and social interaction. Nonetheless, there are enough significant analogic parallels to make the comparison conceptually beneficial, and to generate some rich descriptive imagery.

9.4 SUGGESTIONS FOR FURTHER RESEARCH

Having completed this study, several areas where further research is required have become apparent. The first relates to the GST investigative approach proposed here. The purpose was to see if the approach had utility and would yield practicable and conceptually insightful results. For this, only a limited number of change phenomena and perspectives were examined. Clearly, a much wider examination of change covering more subject domains would enhance our understanding of change still further. The emerging discipline of Complexity Science - with its emphasis on modelling and understanding processes of change and evolution within dynamic complex systems - is likely to be a good hunting ground for further perspectives, phenomena and general principles of change. Specialist fields such as cellular automata (Dewdney, 1985; Wolfram, 1986), neural networks and adaptation (Forrest, 1991), genetic algorithms (Goldberg, 1989) and artificial life (Langton, 1989; 1992) are all likely to contain change ideas worth exploring and building into the change framework developed to date. As has already been noted, in its current form, the framework represents only an initial attempt to capture some of the main themes and principles of change, drawing from the theories and concepts of relatively few subject domains. It is hoped that others will see the merits of the approach and the tentative framework which it produced, and seek to broaden our understanding of change by looking even further afield. In particular, the author would like to see those parts of the framework which are based on specific change phenomena, to be added to and developed - such as the ***embedded dynamics***, ***principles***, ***attributes*** and ***resistance*** components. (Indeed, it would be a good test for the approach if could be used to explore some other generic concept or phenomenon such as *growth* or *learning*).

Secondly, having considered how the GST approach and the change framework could be expanded, there are other ways in which the framework could be applied to the target domain of organisations. This research programme employed case studies. However, as suggested in Chapter 3, there are at least two other ways in which it could be brought to bear on the organisation (see Figure 3.3 - reproduced again here for convenience). One is by using the framework to investigate existing change methodologies and philosophies, such as Business Process Re-engineering (BPR), Soft Systems Methodology or Total Quality Management. A comparison could be made between the general underlying dynamics and principles of change embodied by the framework proposed in this thesis, and the assumptions and perspectives on change implicit within each methodology. For example, does a given change methodology have a rich enough understanding of *resistance*? Does it acknowledge the existence of multi-level, multi-speed change? Does it assume change is achieved via simple linear cause-effect relationships that can be modelled? Part way through this research, the author had the opportunity to begin making this link between the framework developed at that time (February 1995), and a practical change methodology - namely BPR (Stickland, 1996 - forthcoming). One of the findings for example, was that BPR gave insufficient consideration to change and dynamic interaction *between* different process ***levels*** during process analysis and redesign. Further research of this type to assess to what extent the framework reflects the traditions and assumptions of the practitioner's change methods - and vice versa - would then, be another useful way of exploring further the practical implications of this research.

Another means of assessing and applying the framework, is to use it to explain and describe historical studies of organisational change. Access to 'live' change initiatives for the academic can often be limited, but the organisational literature contains a wealth of historical studies that could be analysed with hindsight, using the framework proposed in this thesis.

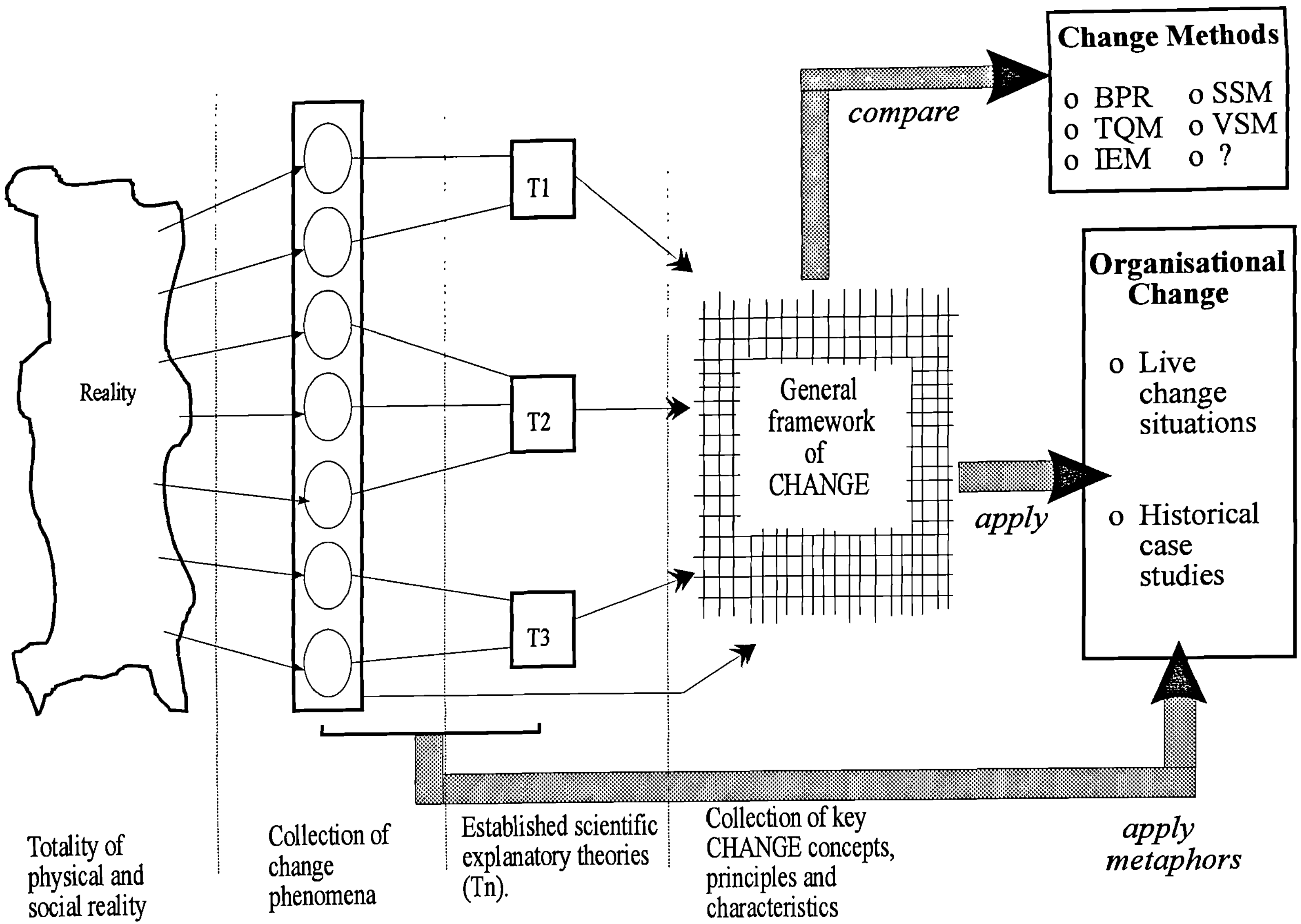


Figure 3.3: The investigative approach applied

Finally, it should be noted that the application of the framework during the two case studies was undertaken in a passive way. That is, it was applied via observation - as an aid to describe events as they unfolded. It was not used as an interventionist tool to assist and direct the planned change or to help design effective change agents. This is a third area of further research that could be undertaken, to take the framework beyond description and analysis and assess whether it has any diagnostic utility in guiding planned change interventions.

However, regardless of the way in which the framework is employed, it is hoped that it will be honed and refined by others in the future, through a variety of organisational applications.

9.5 ORIGINALITY OF THE RESEARCH

This research programme has made a number of original contributions to both the organisational change and applied systems science literature.

<u>Organisational Change</u>:

- The research contains the first major attempt to review the organisation and management literature specifically for descriptions, theoretical models and definitions of change - as opposed to change management approaches. To the author's knowledge, there has not been a systematic attempt to identify and collate organisational research concerned with investigating *what* the fundamental nature of change is. This is probably because there is very little material to work with, coupled with the preoccupation of most organisational change theorists with the problems of *how* to manage change.

- The research presents a rich and coherent framework to describe and analyse organisational change generally, capturing what are deemed to be some of the principal components, attributes and dynamics of change. This is founded on an analysis of the key philosophical issues that underpin it, such as the ontology and epistemology of change, and associated areas of perception, measurement, levels of analysis and degree labelling.

Systems Science:

- The research attempts the first General Systems Theory investigation of change, as one of Boulding's phenomena of *universal significance* (Boulding, 1956). As such, it presents a study of the nature of change as a generic phenomenon common to all systems, exploring various aspects, definitions, perspectives and descriptions of change across a range of subject domains. While the particular discipline of interest for this thesis was organisational behaviour, it is hoped that the framework proposed here will have some utility for theorists in other disciplines also concerned with understanding change.

- In applying the results of the GST analysis to organisational reality through two case studies, this thesis has attempted to build a bridge between a somewhat abstract science concerned with general systems, and a practical science concerned with human activity systems. More such applications of GST analysis are required - particularly to subject domains attempting to understand and tackle real every day problems, such as psychology, international relations and sociology - if the power and value of GST as an investigative approach is to be more widely appreciated and exploited.

To conclude, it is the author's belief that lying hidden among the multitude of specialist disciplines of natural, physical and social science are a wealth of rich and insightful change concepts, suitable for abstraction at a general level, and appropriate for application as metaphors and structural analogies into other fields of study - particularly organisational behaviour and management theory. Several theorists have focused on imagery and concepts from what has become known as the 'new science' - embracing disciplines such as quantum mechanics and chaos theory - drawing parallels with organisational behaviour (eg: Zimmerman, 1992; Wheatley, 1992; Stacey, 1993). Certainly these more recent scientific developments have much to contribute to organisational thinking. However, this thesis has demonstrated that more mundane and well established scientific concepts also have a great deal to offer, and should not be ignored.

In time, it is hoped that the initial framework proposed in this study can be expanded to provide a broad conceptual foundation which captures more common principles, perspectives, dynamics and attributes of change. Not some all-encompassing, grand theory or rigorous prescriptive methodology, but a means of guiding inquiry and promoting creative and original thinking about such an important universal phenomenon. Such a foundation is urgently required, both as a basis for developing new and informed strategies for change management, and to assess the theoretical footing and ontological validity of the many and varied approaches to organisational change already in popular use.

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APPENDIX A

DEFINITION OF TERMS:

Analogy: A specific relational comparison between two subject domains. It is a subset of a *metaphor* (see below) and breaks down the general level description of a metaphor into specific analogical statements. Eg: 'Adjusting culturally to large scale organisational change is like adjusting emotionally following a house move.' or 'The unpredictable responses and behaviour of specific individuals within an organisation, is like the erratic flight motion of individual bees in a swarm.'

Central Limit Theorem: Based upon the *sampling distribution of the mean*, it provides the foundation for statistical inference according to the following three distributions (see Kurtz, 1983):

1) The distribution of the sampling mean will approximate to a normal distribution curve, regardless of the distribution of the variable in question in the original population.
2) The mean of the *sampling distribution of the mean* will be equal to the population mean.
3) The standard deviation (SD) of the sampling distribution has a constant relationship to the SD of the population.

Entropy: A measure of disorder and disorganisation within a system (often expressed as a measure of a system's ability to do work). Within a closed system, entropy is said to increase over time, culminating in system death and loss of identity

Feedback: The change in a given variable or system component caused by its own output. Negative feedback will close the gap between the actual state and the base or reference state. Positive feedback will increase the gap (Beishon and Peters, 1981).

Homomorphism: A 'many to one' mapping between concepts or objects in the source domain and the target domain. Eg: the structure of the solar system can be mapped onto the structure of the atom. Not all mappings correspond, such as size and temperature, so these are dropped. Hence, homomorphic mapping is a simplification process which ensures that key structural information is preserved (Tsoukas, 1991)

Isomorphism: A 'one to one' mapping between concepts or objects in the source domain and the target domain. Eg: a model aircraft that is designed to correspond to the full scale version in every respect, but in miniature.

Metaphor: The transference of information from one subject domain to another where it is not applicable literally. Eg: 'The Corporate Policy Department are the brain behind the recent performance improvement.' or 'The powerful subterranean change processes occurring within BT threaten to erupt like a volcano at any moment.'

Metonymy: The direct replacement or substitution of a word (name or attribute) with that of another. Eg: *crown* for *king* (Oxford Dictionary, 1984)

Negentropy: Short for *negative entropy*, and is a measure of the degree of order (or information) a system possesses. Negentropy is likely to increase if a system is able to receive energy from its environment, or self-organise through bi-directional environmental exchange.

Possibility Space: The notional area which constitutes all the possible future states for a system, through which it charts a course as it moves through time. Clearly only a limited, finite number of states are actually realised.

Stochastic Process: Any process which contains a random variable.

Synergetics: The science of co-operation, coined from the Greek by Hanken (1981; 1983). Synergetics describe how within certain systems (particularly those which demonstrate self-organisation), internal rules, and initial conditions can determine eventual outcome, and 'choose' for the good of the system as a whole.

APPENDIX B

The ontological and epistemological positions outlined in Chapter 4 can be combined to give two broad but distinct schools of thought.

School 1: Ontological View Point The ***objectivist*** position, as outlined by Chalmers (1982) can be stated as follows. Laws, hypotheses and theories possess objective characteristics and structure. These exist in complete independence of any one scientist or group of scientists perception and consideration of them. Even if an individual is aware of a theory's existence, its characteristics and structure are valid, whether that individual believes in them or not. Moreover, following the objectivist's logic, a given theory will also possess problematic aspects and potential development areas quite independent of the proponents recognition or appreciation of them. The objectivist position compares favourably with Burrell and Morgan's ***realist*** conceptualisation of social science based theories. According to the realist: "...the social world external to individual cognition is a real world made up of hard, tangible and relatively immutable structures...[and] exists independently of an individuals appreciation of it." (Burrell and Morgan 1979: 4)

School 1: Epistemological View Point The ***rationalist*** position as described by Chalmers (1982: 101) "...asserts that there is a single, timeless, universal criterion with reference to which the relevant merits of rival theories are to be assessed." Hence, for the rationalist there always exists some foundational reference point in which theories can be anchored, and all knowledge related. From it, one can advance securely out to explore and push back the frontiers of knowledge. This position is very similar to Burrell and Morgan's concept of ***positivism***, which searches for "...regularities and causal relationships..." in the social world (Burrell and Morgan, 1979: 5). These are seen as base points similar in function to the rationalists 'universal criterion', from which one launches out into investigating, explaining and predicting the phenomena of the social world.

Summary of School 1: To summarise, adherents to School 1 take physical reality as objective and given, regardless of any perception, belief or knowledge of it.

Furthermore, they believe there exists within it some unassailable theoretical reference point.

SCHOOL 2 EXPLAINED

School 2: Ontological View Point Chalmers ontological contribution to School 2 revolves around the concept of ***individualism*** (Chalmers, 1982). This is based upon the premise the physical world can be understood purely in terms of beliefs, opinions and values held in the minds of individuals. These constitute what Checkland (1981) and Bertalanffy (1962) commonly call 'weltanschauung' or world view. It is worth noting however, that the beliefs and opinions which constitute this world view must be properly substantiated and justified, before they can be considered and accepted as 'true'. (see Armstrong, 1973). Unlike the objectivist of School 1, adherents of individualism believe that the relationships and structure of the physical world do not exist independently of a persons perception and recognition of them. Rather, it is the intellect of man which imposes structure and defines relationships, to enable him to explain and cope with the complexity he is faced with.

Burrell and Morgan's ***nominalism*** is a similar ontological classification to individualism, but for social science theories. The concept of nominalism is centred on the premise that the observable world outside and independent of individual awareness, possess no 'real' structure. It is:

> "...nothing more than names, concepts and labels which are used to structure reality. (These names)...are regarded as artificial creations whose utility is based upon their convenience as tools for describing, making sense of and negotiating the external world." (Burrell and Morgan, 1979: 4)

A further related ontological strand to School 2 not mentioned up to now, but is worth mentioning here, is that of ***instrumentalism*** (Chalmers 1982). This treats theories merely as a 'calculating device' which enables one collection of observable phenomena to be mapped onto another. However, unlike the individualist, the instrumentalist is not concerned whether the theory is correct or valid in actuality, as a true representation of a given phenomena. The instrumentalist attitude is clearly illustrated by Oslander: writing in the Preface to Copernicus' work 'The Revolutions of Heavenly Spheres' about the latter's conjectures on planetary motion, he remarks: "...these hypotheses need not be true or even probable; if they provide a calculus consistent with the observations that alone is sufficient." (Quoted in Rosen, 1962: 125)

School 2: Epistemological View Point The epistemological position of School 2 is characterised by the twin concepts of ***relativism*** and ***anti-positivism***. The relativist denies the existence of some "...universal ahistorical standard of rationality..." (Chalmers, 1982: 102), which can be used as a bench mark in the pursuit of scientific knowledge. Instead he proposes that a given theory should be appraised and selected, according to the judgments of the specialist or group of specialists to whom the theory is relevant. Hence we find the 'universal criterion' being replaced by the specific world view of a group of specialists. As Kuhn has suggested, clearly speaking from a relativist standpoint: "...there is no standard higher than the assent of the relevant community." (Kuhn, 1970: 94).

Akin to the concept of relativism as described by Chalmers, is Burrell and Morgan's notion of anti-positivism. This takes the view that the social world: "...can only be understood from the point of view of the individuals who are directly involved in the activities which are to be studied... One has to understand from the inside rather than the outside." (Burrell and Morgan, 1979: 5). The anti-positivist is against the idea that scientific endeavour can identify laws and principles which are objectively foundational to the social world. He would therefore deny that objective 'scientific knowledge' is ever derivable.

Summary of School 2: To summarise School 2 then, it can be said that it views the world as an entity which only possesses structure and identifiable elements and relationships, in so far as they are observed and noted through the disparate world views of individuals. No universal point of reference exists to harmonise these differing world views. Instead a theory is appraised and favoured over alternatives according to its standing and credibility within the group of specialists to whom it is relevant.

APPENDIX C

Electron Arrangements for Periodic Table Elements

At.	Element	K	L		M			N				O				P				Q
No.		s	s	p	s	p	d	s	p	d	f	s	p	d	f	s	p	d	f	s
1	H	1																		
2	He - *VIII*	2																		
3	Li - *I*	2	1																	
4	Be	2	2																	
5	B	2	2	1																
6	C	2	2	2																
7	N	2	2	3																
8	O	2	2	4																
9	F	2	2	5																
10	Ne - *VIII*	2	2	6																
11	Na - *I*	2	2	6	1															
12	Mg	2	2	6	2															
13	Al	2	2	6	2	1														
14	Si	2	2	6	2	2														
15	P	2	2	6	2	3														
16	S	2	2	6	2	4														
17	Ci	2	2	6	2	5														
18	Ar - *VIII*	2	2	6	2	6														
19	K - *I*	2	2	6	2	6		1												
20	Ca	2	2	6	2	6		2												
21	Sc	2	2	6	2	6	1	2												
22	Ti	2	2	6	2	6	2	2												
23	V	2	2	6	2	6	3	2												
24	Cr	2	2	6	2	6	4	1												
25	Mn	2	2	6	2	6	5	2												
26	Fe	2	2	6	2	6	6	2												
27	Co	2	2	6	2	6	7	2												
28	Ni	2	2	6	2	6	8	2												

At. No.	Element	K s	L s p	M s p d	N s p d f	O s p d f	P s p d f	Q s
29	Cu	2	2 6	2 6 10	1			
30	Zn	2	2 6	2 6 10	2			
31	Ga	2	2 6	2 6 10	2 1			
32	Ge	2	2 6	2 6 10	2 2			
33	As	2	2 6	2 6 10	2 3			
34	Se	2	2 6	2 6 10	2 4			
35	Br	2	2 6	2 6 10	2 5			
36	Kr - *VIII*	2	2 6	2 6 10	2 6			
37	Rb - *I*	2	2 6	2 6 10	2 6	1		
38	Sr	2	2 6	2 6 10	2 6	2		
39	Y	2	2 6	2 6 10	2 6 1	2		
40	Zr	2	2 6	2 6 10	2 6 2	2		
41	Nb	2	2 6	2 6 10	2 6 4	1		
42	Mo	2	2 6	2 6 10	2 6 5	1		
43	Tc	2	2 6	2 6 10	2 6 6	1		
44	Ru	2	2 6	2 6 10	2 6 7	1		
45	Rh	2	2 6	2 6 10	2 6 8	1		
46	Pd	2	2 6	2 6 10	2 6 10			
47	Ag	2	2 6	2 6 10	2 6 10	1		
48	Cd	2	2 6	2 6 10	2 6 10	2		
49	In	2	2 6	2 6 10	2 6 10	2 1		
50	Sn	2	2 6	2 6 10	2 6 10	2 2		
51	Sb	2	2 6	2 6 10	2 6 10	2 3		
52	Te	2	2 6	2 6 10	2 6 10	2 4		
53	I	2	2 6	2 6 10	2 6 10	2 5		
54	Xe - *VIII*	2	2 6	2 6 10	2 6 10	2 6		
55	Cs - *I*	2	2 6	2 6 10	2 6 10	2 6	1	
56	Ba	2	2 6	2 6 10	2 6 10	2 6	2	
57	La	2	2 6	2 6 10	2 6 10	2 6 1	2	
58	Ce	2	2 6	2 6 10	2 6 10 2	2 6	2	
59	Pr	2	2 6	2 6 10	2 6 10 3	2 6	2	
60	Nd	2	2 6	2 6 10	2 6 10 4	2 6	2	

At. No.	Element	K	L		M			N				O				P				Q
		s	s	p	s	p	d	s	p	d	f	s	p	d	f	s	p	d	f	s
61	Pm	2	2	6	2	6	10	2	6	10	5	2	6			2				
62	Sm	2	2	6	2	6	10	2	6	10	6	2	6			2				
63	Eu	2	2	6	2	6	10	2	6	10	7	2	6			2				
64	Gd	2	2	6	2	6	10	2	6	10	7	2	6	1		2				
65	Tb	2	2	6	2	6	10	2	6	10	9	2	6			2				
66	Dy	2	2	6	2	6	10	2	6	10	10	2	6			2				
67	Ho	2	2	6	2	6	10	2	6	10	11	2	6			2				
68	Er	2	2	6	2	6	10	2	6	10	12	2	6			2				
69	Tm	2	2	6	2	6	10	2	6	10	13	2	6			2				
70	Yb	2	2	6	2	6	10	2	6	10	14	2	6			2				
71	Lu	2	2	6	2	6	10	2	6	10	14	2	6	1		2				
72	Hf	2	2	6	2	6	10	2	6	10	14	2	6	2		2				
73	Ta	2	2	6	2	6	10	2	6	10	14	2	6	3		2				
74	W	2	2	6	2	6	10	2	6	10	14	2	6	4		2				
75	Re	2	2	6	2	6	10	2	6	10	14	2	6	5		2				
76	Os	2	2	6	2	6	10	2	6	10	14	2	6	6		2				
77	Ir	2	2	6	2	6	10	2	6	10	14	2	6	7		2				
78	Pt	2	2	6	2	6	10	2	6	10	14	2	6	9		1				
79	Au	2	2	6	2	6	10	2	6	10	14	2	6	10		1				
80	Hg	2	2	6	2	6	10	2	6	10	14	2	6	10		2				
81	Tl	2	2	6	2	6	10	2	6	10	14	2	6	10		2	1			
82	Pb	2	2	6	2	6	10	2	6	10	14	2	6	10		2	2			
83	Bi	2	2	6	2	6	10	2	6	10	14	2	6	10		2	3			
84	Po	2	2	6	2	6	10	2	6	10	14	2	6	10		2	4			
85	At	2	2	6	2	6	10	2	6	10	14	2	6	10		2	5			
86	Rn - ***VIII***	2	2	6	2	6	10	2	6	10	14	2	6	10		2	6			
87	Fr - ***I***	2	2	6	2	6	10	2	6	10	14	2	6	10		2	6			1
88	Ra	2	2	6	2	6	10	2	6	10	14	2	6	10		2	6			2
89	Ac	2	2	6	2	6	10	2	6	10	14	2	6	10		2	6	1		2
90	Th	2	2	6	2	6	10	2	6	10	14	2	6	10		2	6	2		2
91	Pa	2	2	6	2	6	10	2	6	10	14	2	6	10	2	2	6	1		2
92	U	2	2	6	2	6	10	2	6	10	14	2	6	10	3	2	6	1		2

At. No.	Element	K	L		M			N				O				P				Q
		s	s	p	s	p	d	s	p	d	f	s	p	d	f	s	p	d	f	s
93	Np	2	2	6	2	6	10	2	6	10	14	2	6	10	4	2	6	1		2
94	Pu	2	2	6	2	6	10	2	6	10	14	2	6	10	6	2	6			2
95	Am	2	2	6	2	6	10	2	6	10	14	2	6	10	7	2	6			2
96	Cm	2	2	6	2	6	10	2	6	10	14	2	6	10	7	2	6	1		2
97	Bk	2	2	6	2	6	10	2	6	10	14	2	6	10	8	2	6	1		2
98	Cf	2	2	6	2	6	10	2	6	10	14	2	6	10	10	2	6			2
99	Es	2	2	6	2	6	10	2	6	10	14	2	6	10	11	2	6			2
100	Fm	2	2	6	2	6	10	2	6	10	14	2	6	10	12	2	6			2
101	Md	2	2	6	2	6	10	2	6	10	14	2	6	10	13	2	6			2
102	No	2	2	6	2	6	10	2	6	10	14	2	6	10	14	2	6			2
103	Lr	2	2	6	2	6	10	2	6	10	14	2	6	10	14	2	6	1		2
104	Ku	2	2	6	2	6	10	2	6	10	14	2	6	10	14	2	6	2		2
105	Ha	2	2	6	2	6	10	2	6	10	14	2	6	10	14	2	6	3		2

APPENDIX D

Example Initiatives for Each Action Point

1. Customer focus must be the unifying theme for teams.
   Example Initiatives: Local Partnership, Winning Matters
2. A clear vision, list of goals and plan of action is required from senior level.
   Example Initiative: Corporate and Divisional Scorecards
3. A step change is required in management visibility.
   Example Initiative: Speakup Live, Employee Evenings
4. All managers should be focusing on people motivation measures.
   Example Initiative: Performance and Development Framework, Senior Executive Competencies
5. The relationship between employees and the company needs to be defined with greater clarity.
   Example Initiative: "For a Better Life", new Employee Handbook and Line Managers guide.
6. A movement away from control towards freedom of action on behalf of the customer is necessary.
   Example Initiative: Learning from Breakout pilots
7. A direct link between achievement and rewards must be established.
   Example Initiative: Capability Management
8. Team work needs to be more effective.
   Example Initiative: Case Teams, Local Partnership

APPENDIX E

To achieve our strategic objectives and ensure long term competitive advantage for BT.....

I am proud to be an ambassador for BT, and have a "can do, will do" attitude. I am driven by the need to achieve and work with enjoyment and energy. I feel valued, motivated and respected, and in turn value the integrity, capability and competence of others.

I am instinctively customer focused - listening, understanding and responding to our customers, and measuring my performance against their satisfaction.

I work flexibly in a number of smaller teams across the BT wide team. I have a mix of objectives, both individual and shared - and I understand my own team role and how that fits into the company plan.

I am inspired by BT leaders, who model the BT Values, and who are consistent in what they say, do and measure. I am impressed by the way they walk the job, listen, and learn from what they see and here.

My manager directs, coaches, guides and supports me. Good performance and extra effort are promptly recognised and rewarded - if there are any particular problems or if I have made a mistake they are discussed quickly, directly and supportively.

I am always learning, and use feedback on what I and my colleagues do to help me improve. I have access to the training and resources I need to do my job effectively and safely.

We communicate in everyday language, clearly, honestly, timely, relevant and two way. I hear and understand the messages I receive about BT and can discuss openly and positively the impact they will have on me and my team.
(Source: reproduced with permission from a BT internal document)